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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Competing for Business Honours

THIS journal has entered two aircraft, with staff pilots, for the Royal Aero Club's Business and Touring Aircraft Competition being held at Shoreham today and tomorrow. We have done so because we are anxious to support the most important light aircraft meeting to be held since the war. Twelve months ago such a contest would have been without meaning; and it is possible now only because of the significant influx of imported aircraft since restrictions were eased last June.

The British-owned executive aircraft is no longer an indigenous product. But in spite of long neglect of the home market by our own aircraft manufacturing industry the present demand for workaday but efficient business and touring aircraft is salutary; over 70 US, French, Czechoslovakian and Italian twins and singles have been imported within the past twelve months. Downright good salesmanship has met with enthusiastic response.

How is the potential private or business owner to assess the merits of each new type? From titillating brochures extolling colour and comfort? From comparison of performance figures? On price or reputation? With an unfamiliar product (so different from our outmoded native designs) how can the mediocre be distinguished from the good?

Our own contribution to easing this impasse is the series of *Flight* air tests, now a frequent and eagerly accepted burden on the pilot members of the staff. In the Business and Touring Competition the Royal Aero Club has devised a contest in which new types—and for comparison, some old ones—are placed against a common yardstick. And apart from the sheer fun of the event and the interest in private aeroplanes it will excite, that is a significant contribution to the British business-aircraft scene. The idea is good, the rules are good and competition should be keen.

Of Mousetraps and Men

IN this issue we record that Gloster Aircraft, one of our most renowned fighter firms, are about to deliver their last aeroplane—although, happily, they are not severing their connections with aviation. The company are already busily engaged in non-aeronautical work and in this they are following a trend which has long been marked in the British aircraft industry and is becoming increasingly evident in America. There is an irreverent belief among aeronautical engineers that in the more traditional engineering industries parts are never "designed" at all, but are hacked out of cast iron or brass by a venerable craftsman using his grandfather's file. This is a concept, born of ignorance, which is scarcely borne out in practice.

Nevertheless, the aircraft industry has always been forced to reach into the technological unknown at an exceptional rate. Its products must be smaller and lighter than comparable ground-based units, and they may have to operate in exceedingly adverse conditions over an exceptional range of environments. Repeated throughout every airborne part, such requirements have created a discipline of critical and painstaking design which really does surpass that of longer-established industries. The latter are now at last waking up to the value of design teams with trained skill; but the technical approach of the aviation industry is still a pre-requisite to the world's best mousetrap. Although most of this expertise is still applied to aeronautics, with diversification it is no longer a closed shop.

FROM ALL QUARTERS

Heaviest Yet

TIMELY and spectacular in what has become the Soviet tradition, the launching into orbit on May 15 of a 4,540kg (10,010lb) artificial Earth satellite by Russia was stated to have as its purpose the testing of "all the equipment for a manned journey into space." The satellite included a 2½-ton cabin, containing a "dummy man"; and an instrument compartment (equipment other than that in the cabin was said to weigh 1½ tons).

The initial orbit of the satellite, officially designated a "spaceship," was from 312 to 369km altitude (193-230 miles), with an orbital period of 91.2min. It was reported that all instruments on board were working normally, and that the equipment was maintaining "normal living conditions" inside the cabin.

According to Prof Vladimir Dobronravov, the cabin contains "all the necessary equipment to give information on human physical processes during the flight"—information which is being telemetered to Earth. After all the "necessary information" had been received, a command radio signal would separate the cabin from the remainder of the satellite, and the cabin would re-enter the Earth's atmosphere and would burn up. The professor said that the main purpose of the satellite was to test the design of the cabin, and that the spaceship would be guided "to some extent."

Vickers Start Hovercraft Business

LAST Tuesday SR-N1, the Saunders-Roe Hovercraft, was demonstrated between Nine Elms Wharf and Westminster Bridge on the River Thames. Watching were MPs and directors of National Research Development Corporation and Hovercraft Developments Ltd. The SR-N1 appeared to achieve nearly 50kt.

The previous day HDL and Vickers announced that "Negotiations are almost concluded between Vickers and Hovercraft Development Ltd for the production by Vickers of Hovercraft." One will be about four to five tons—a fast hovercraft launch—and the other will be in the range of 15 to 25 tons. "This will be a vehicle suitable for operation, say, as a car and passenger ferry." The work is centred at the former Supermarine works at South Marston.

U-2 Round-up

FROM the many thousands of words written in the Soviet and Western Press during the past week about the Lockheed U-2 shot down near Sverdlovsk on May 1 it is possible to glean one or two pieces of new information. The Soviet Premier himself has quoted the height at which the aircraft was destroyed as 66,000ft. Certain other Soviet sources have said 68,000ft. The military paper *Red Star* has published an account of the interception, noting that "the radar locked tightly on the target . . ." and claiming a direct hit. According to one journal the missile warhead exploded under the rear of the target, the pilot, Francis Powers, being shielded from most of the blast and fragments by the engine [J75]. He is said to have baled out at 40,000ft.

According to the *Los Angeles Times* Lockheed's California Division delivered 25 U-2s, at least six of which have been lost. Since 1956 Lockheed have operated ten under contract to NASA (Powers is a Lockheed employee). Meanwhile, the governments of Norway and Pakistan have announced that U-2s will be denied facilities in their territory, the Japanese opposition has called for their expulsion and other nations have either issued a rash of contradictions about their complicity or have maintained silence. Silent is the British Government; and the Air Ministry have not so far commented on the death of Sqn Ldr Christopher Walker (*Flight*, July 18, 1958) who according to a newspaper report was one of four RAF officers "posted to the US two years ago for spy-plane training."

de Havilland Plans

IN the address of the chairman (Sir Aubrey Burke) of de Havilland Holdings for the year ended September 30 last, the point is made that over 90 per cent in value of all classes of stockholders accepted the take-over offer of the Hawker Siddeley Group. By the middle of April 1960, 48 Comets had been sold and 30 delivered; more contracts for Comets are expected and it is hoped to dovetail their production into the D.H.121 programme. More than one version of the latter is being planned to "satisfy the whole world market in the short and short/medium ranges." Production of Doves (512 sold) and Herons (139) continues, and Sea Vixen production "should keep our capacity occupied until about 1963, and further orders are anticipated." Gyron Juniors are going into full production for the Blackburn NA.39, as are the Gnome turboshaft engines for the RAF Whirlwinds. The development of a more advanced air-to-air missile than Firestreak is proceeding well; the company await Government policy on space before they can assess the future of the Blue Streak programme.

Bristol Jubilee Report

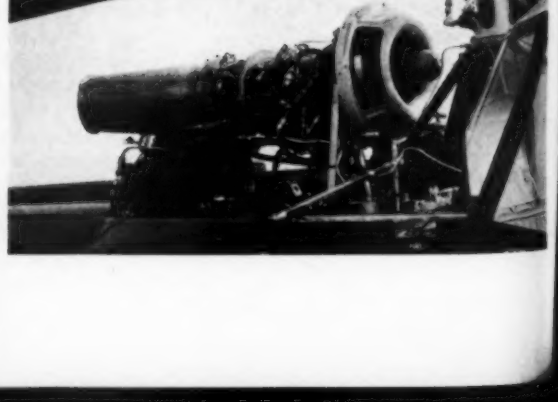
PRESENTING the Bristol Aeroplane Company's *50th Report and Accounts*—in this context the "50th" is a matter for justifiable pride—the chairman (W. R. Verdon Smith) remarks that there have been "great changes both in our corporate structure and in the range of our aviation interests."

Among facts he records are that 19 Britannias were delivered during last year and that no more will be laid down beyond the total of 83 to which Bristol Aircraft have long been committed; that progress with the Type 188 supersonic research aircraft is limited by the maximum rate of expenditure imposed as a term of the contract; and that Bristol Aircraft recently submitted a supersonic-airliner feasibility study to the MoA and hope for the "opportunity to design and manufacture the world's first *long-range* [our italics] supersonic airliner."

Mr Verdon Smith also says that the Bristol/Ferranti Bloodhound has always been close to its original schedule; the specified performance has been exceeded, "valuable developments not anticipated" have been added to it, and the development of longer range and greater defensive power is proceeding according to plan. In the helicopter field, Sycamore production ceased last year after 178 had been delivered; and technical difficulties with the Bristol 192 Belvedere were overcome by the end of 1959 and production is proceeding well. Of engines, he remarks that good progress is being made with the advanced Bristol Siddeley Olympus selected for the TSR.2; and that the BE.53 turbofan for VTOL applications ran on the test-bed last autumn for flight trials later this year.

GUINEA PIG: The first Bristol 188 airframe being loaded on a trailer for its journey to RAE Farnborough, where it will be used for structural testing. In the background is the second airframe, which will be completed for the flight-research programme due to begin this year

GNOME-WASP: First seen at the SBAC Show last September, the Westland (Saunders-Roe) Wasp, powered by a de Havilland Gnome H.1000, flew from Eastleigh for 45min on May 3 in the hands of test pilot Ken Reed. This close-up shows the neat engine installation



FIRST VISIT to the de Havilland Engine Co since D.H. and Hawker Siddeley joined forces was paid recently by Sir Roy Dobson, vice-chairman and managing director of the latter group. He is seen at fourth from left with (l to r) M. G. Ash, financial director; W. F. Shaylor, sales director; Sir Aubrey Burke, D.H. group chairman; Hugh Buckingham, D.H. Engines managing director; and Dr E. S. Moult, technical director. In the background is the famous Comet (two Gipsy Six R) which won the England - Australia race of 1934

Magic of a Name

LINES written in the 18th century by the Scottish poet Thomas Campbell—

Who hath not owned, with rapture smitten frame,
The power of grace, the magic of a name?

—gave a title to Harold Nockolds for his book *The Magic of a Name*, in which he told the story of Rolls-Royce Ltd. Now the same title has been used for a 35mm Eastmancolor film based on the book, running for just over 25 min and making good use of that short time for a comprehensive portrayal of Rolls-Royce activities. In the words of Air Cdre W. Whitney Straight, Rolls-Royce deputy chairman, who introduced a Press showing of *The Magic of a Name* in London on May 12, it is "the first film which fully describes the activities of the company." Its air-to-air sequences, of aircraft powered by Rolls-Royce engines, inevitably predominate; but quick glances are taken at other aspects of the company's work, and convincing emphasis is placed on the value of research.

Copies of the film (in 16mm and 35mm) are available to recognized organizations through Sound-Services Ltd, Wilton Crescent, London SW19.

RAeS Honours

FOLLOWING custom, the Royal Aeronautical Society presented its main annual awards on the occasion—yesterday, May 19—of the delivery of the Wilbur Wright Memorial Lecture. This was the 48th in the series and was being given by M. J. Lighthill, director of the RAE Farnborough, on *Mathematics and Aeronautics*. The new president of the RAeS, Dr E. S. Moult, was presiding.

Two honorary fellowships, the highest honour the Society can confer (the total number of honorary fellows at any one time is limited to 35), have been awarded this year to Prof W. J. Duncan, Professor of Aeronautics and Fluid Mechanics at the University of Glasgow and Chairman of the Aeronautical Research Council, and to Sir George Edwards, Managing Director of Vickers-Armstrongs (Aircraft) Ltd and a past president of the RAeS. Sir Frederick Handley Page, who has been an honorary fellow since 1949, has been awarded the Gold Medal of the Society.

The full list of awards being presented yesterday is as follows:—

Honorary Fellowships: Prof W. J. Duncan, CBE, DSC, FRS, FRAES; and Sir George Edwards, CBE, BSC, FRAES, HONFIAS.

Gold Medal (highest honour the Society can confer for work of an outstanding nature in aeronautics): Sir Frederick Handley Page, CBE, FCGI, HONFRAES, HONFIAS, HONMINSTT, chairman and managing director of Handley Page Ltd and Lord Lieutenant of the County of Middlesex, for his outstanding contribution to British aircraft design for more than fifty years.

Silver Medal (for work of an outstanding nature in aeronautics): R. H. Chaplin, OBE, BSC, FRAES, Executive Director and Chief Designer of Hawker Aircraft Ltd, for his achievements in the design and development of military aircraft.

Bronze Medal (for work leading to an advance in aeronautics): H. G. R. Robinson, BSC, ACGI, Royal Aircraft Establishment, for his work leading to practical achievement in ballistic missiles.

British Gold Medal for Aeronautics (for outstanding practical achievement leading to advancement in aeronautics): B. E. Stephenson, FRAES, Director of Engineering, Vickers-Armstrongs (Aircraft) Ltd, for his outstanding practical achievements in aircraft design and development.

AMONG THE LARGEST JIGS ever erected in a British aircraft factory, two of these rear-fuselage fixtures are now being set up at Short Bros and Harland's Belfast works for the SC.5 Britannic programme. In this twin structure two rear fuselages will be built simultaneously and the lower framework will serve as a removable trolley on which the sub-assembly can be towed to the production line

British Silver Medal for Aeronautics (for practical achievement leading to advancement in aeronautics): Philip A. Wills, CBE, AFRAES, for his practical achievements in the service of British gliding.

Wakefield Gold Medal (for contributions towards safety in aviation): E. G. Broadbent, MA, FRAES, for his contribution to aircraft safety through the theory of aeroelasticity. Mr Broadbent is with the RAE Farnborough.

R. P. Alston Medal (for practical achievement associated with the flight testing of aircraft): Wg Cdr R. P. Beamont, OBE, DSO, DFC, ARAES, manager of flight operations and chief test pilot, English Electric Aviation, for his practical achievements in flight testing supersonic aircraft.

N. E. Rowe Medals (for the best lecture given before any branch of the Society by a member of a branch): C. J. Wood, BSC(ENG), for his lecture *Transonic Buffeting on Aerofoils* (21-26 age group); J. A. Miller for his paper *A History of the Development of Flight Refuelling* (under 21 group). Both recipients are members of the Brough branch.

IN BRIEF

At Cape Canaveral on May 13 the first Project Echo launch, in which a 100-ft radio-reflector balloon was to have been placed in orbit, was unsuccessful. The launching vehicle was a three-stage Thor-Delta.

The theme of this year's European Congress of Aviation Medicine, being held in London from August 29 to September 2, is *Human Problems in Supersonic and Hypersonic Flight*.

A 297-mile flight from Nympsfield, Glos, to Cockburnspath, Berwickshire, was made by Peter Scott in an Olympia 419 sailplane on May 14, in an attempt to reach Portmoak, on the shores of Loch Leven.

Air Marshal Sir Geoffrey Tuttle, KBE, CB, DFC, Deputy Chief of the Air Staff until his retirement from the RAF last year, has joined Vickers-Armstrongs (Aircraft) Ltd. It is understood that he will assist the managing director, Sir George Edwards, in his additional responsibilities arising from the Vickers/English Electric/Bristol merger and the formation of the British Aircraft Corporation.

We regret to record that one of the Tiger Club's best aerobatic pilots, and chairman and instructor of Fakenham Flying Group, Elwyn McAully was killed in a flying accident to G-APDZ, the Bishop version of the Tiger Moth, at Little Snoring on May 12. He was practising aerobatics at the time, and was reported to have failed to complete an outside loop when his aircraft hit the ground. At Kidlington on May 7, McAully was pilot of Turbulent G-APZZ which was badly damaged on the ground when an Auster collided with it.

A demonstration tour of the Polish PZL-102B Kos light aircraft, organized by Norco Engineering Ltd, agents for the type, is to begin at Biggin Hill on Thursday and Friday of next week (May 26-27).

Deputy chief inspector of Bristol Aircraft Ltd since 1954, J. B. Mackirdy has been appointed works manager of the company's guided-weapons factory at Cardiff. He succeeds R. A. Burden, who is going to the Pyrene Co Ltd. Mr Mackirdy was previously with Avro, and before that with Scottish Aviation.

The pilot and co-pilot of the Swiss mountain expedition's aircraft *Yeti*, a Pilatus Porter, arrived safely in Pokhara on May 13 and reported that the aircraft was a total wreck after crashing and catching fire shortly after take-off from an acclimatization camp near Mount Dhaulagiri on May 5.

A special Colour Number of our associated journal *Amateur Photographer* is being published next Wednesday (May 25).

"FLIGHT" STORY AND PICTURES

By J. M. RAMSDEN

B·O·A·C ROLLS-ROYCE 707

TO NEW YORK BY THE CORPORATION'S NEW AMERICAN JET

Thrusting away from New York International, and at this height still with some of runway 13R's 11,250ft in hand, BOACs Conway-powered 707-420 G-APFD takes off at 262,000lb. Conditions are almost standard—Jamaica Bay sea level, 15°C, and a 6kt wind component. Passengers who were in the terminal a few minutes ago will be in London in six hours and twenty minutes non-stop

VERY soon now BOAC are to introduce on the world's most competitive international route their fourth new aircraft within 3½ years—a rate of re-equipment which has inevitably made profits elusive. The corporation introduced the DC-7C in January 1957, the Britannia 312 in December 1957, and the Comet 4 in October 1958. But the advent of the fourth type, the Boeing 707-420, promises a period of greater stability —even though BOAC will have all four types at work on the North Atlantic during the present summer season. The commercial background to the new service is here described by a staff member who last week accompanied the second of 12 proving flights.

THE date originally set by BOAC for the inauguration of Boeing 707 services was April 18, 1960. This was when the corporation was expecting delivery in December 1959; but the delays in the airworthiness certification programme have put this date back by seven weeks, to June 6. It is possible—at the time of writing one might say probable—that this date will be advanced a little. The proving-flight programme calls for a dozen round trips, the eleventh of which was due to leave London today, May 20. The last flight is due back on May 25; so it seems probable that BOAC's 707s will start earning their keep before June 6.

Inevitably the delay has cost the corporation a lot of money. The 707-less weeks fall in the money-making season, particularly as regards eastbound transatlantic travel (which, agents report, has been noticeably stimulated by the royal wedding). So the corporation is having to do the best it can during nearly two of the five peak summer months on the North Atlantic with equipment that does not match the 707s of its chief competitors PanAm and TWA (the last-named having six months ago regained the second place from which BOAC ousted it a year ago). The consequence is a revenue loss calculated over the whole year of about £2 million. When the net loss is reckoned up, taking into account the difference between fixed and variable route costs, the final loss will probably work out at about £1.1 million—a serious blow to the 1960-61 profit-and-loss account.

When it became known that BOAC's 707s were going to be late on delivery—everyone else's having been ahead of schedule in accordance with the perverse luck which has so many times dogged BOAC's equipment plans—the corporation carried out a sort of revenue-rescue operation. Existing Comet 4, Britannia 312 and DC-7C schedules were redeployed so that the maximum possible utilization could be squeezed out of every available aircraft. At one point a few weeks ago the corporation considered robbing other routes of Britannia 312 and Comet 4 capacity; after consideration this was found to be politically undesirable. The redeployment has involved an increase in the London - New York frequency of the Comet 4, an aircraft which is best used on the North Atlantic (as on other routes) at the highest possible frequency. At the same time Britannia 312s and DC-7Cs have been operated at higher load-factors.

BOAC will on June 6 (or whatever earlier date it may be) apply the 707 to the London - New York route at a frequency of three flights per week. Just over a week later, on June 15, the frequency will be stepped up to daily. Flights will be in daylight westbound (leaving London at 1300hr each day and arriving in New York only two clock hours later) and overnight eastbound —a 24hr round trip. It was originally the corporation's policy to get enough pilots trained to start right away at a daily frequency. This aim has nearly been achieved despite the re-adjustments that have had to be made to the route-proving programme, the second flight of which we had the good fortune to accompany. (So far as conversion-training is concerned, BOAC got off to a good start on April 4 with a programme involving 24 pilots and 21 flight engineers based on Tucson Airport, Arizona. This programme, which at Tucson was at a sustained intensity of 26 hours

On the ramp by BOAC's departures area at New York International is the corporation's new American jet. This is a view from the spectators' deck on top of one of the arrivals piers

a day with two aircraft, will be continued from St Mawgan, Cornwall. Thus the corporation has got well ahead with basic 707 airmanship training.) Boeing will quickly catch up with their original delivery programme, which called for six aircraft to be in BOAC's hands by the end of May. Three more will be handed over between June and September and two per month during each of the last three months of 1960. The whole fleet of 15 will have been delivered by the end of the year.

The Comet 4 will now be progressively displaced by the 707, being released from the North Atlantic to step up frequencies on other BOAC routes. For example, the South Atlantic will be the Comet's domain until traffic volume builds up to justify a larger jet—which by then will probably be the VC10. But the Comet 4 will not be taken completely off the North Atlantic until October, the end of the present summer season. The smaller jet was of course never intended for this route, though it appears to have done a very good job despite its limited seating capacity (North Atlantic traffic densities call for a bigger vehicle for the best economics) and inadequate tankage.

In the "Rolls-Royce 707," as BOAC promote their new American jet, the corporation claim to have the fastest aircraft on the route*—and speed is a particularly saleable commodity in the world's most keenly contested international air travel market. So it is unlikely that the corporation will join the North Atlantic jet speed club formed by Pan American, TWA and Air France. These three 707 operators have agreed to publish common schedules in order to avoid a silly advertising battle. BOAC are scheduling 7hr 20min westbound and 6hr 20min eastbound. These times compare with the PanAm and TWA (707-320) London - New York schedules of 7hr 40min and 6hr 40min. Thus the advantage of BOAC's schedule is 20min each way (stop press: page 701). But BOAC say that they do not intend to emphasize the "fastest" angle in their 707 promotion. In fact, one official agreed "most emphatically" with our suggestion that the airlines should try to avoid costly speed wars. Obviously BOAC will co-ordinate their London - New York scheduling with Air-India, who operate the same type of 707. Qantas operate JT3 (eventually turbofan JT3D) 707s, and their times will be rather slower than those of their partners BOAC and Air-India. (On our proving flight we caught up a Qantas 707 that had left New York 20 minutes before us.)

The Boeing 707 will operate throughout this summer with 34 first-class seats, four-abreast at 42in pitch, and 97 economy-class seats at 34in pitch six-abreast. This compares with the mixed-class Comet 4 configuration of 24 first-class at 47in pitch four-abreast, and 48 economy-class at 34in pitch five-abreast. The greater first-class pitch on the Comet is a concession gained by BOAC at the last IATA traffic conference to enable the aircraft to compete on more equitable terms with the faster 707 and DC-8 jets. The famous Monarch service will be retained, and it will be exclusive to the 707. For the first time BOAC's Monarch customers will share an aeroplane with the trippers; but separation will be complete, neither class being aware of the other's existence, except perhaps for an occasional glimpse through the midships partition. It is not possible for BOAC to offer the ultimate to their Monarch passengers in terms of such creature comforts as leg room and berths; by IATA agreement, these are concessions allowed only to the propeller aeroplanes.

Curiously enough, the latest Boeing figures show that the −420 and the −320 cruise within 3kt of each other. The −320 is actually 3kt faster (457kt at 40,000 and 190,000lb) at "best range, best cost" cruise settings, while the −420 is 3kt faster (524kt at 25,000ft and 190,000lb) at "best speed, best cost" settings. But—and this is the point—the 420's fuel consumption is roughly 3 per cent better, so that this aircraft can be flight-planned faster for the same fuel reserves.

707 and Comet Economics

An economic comparison between the 707 and the Comet 4 is illuminating. Though in terms of cost per aircraft mile the 707 is more expensive to operate, its greater size brings down specific costs substantially relative to the Comet 4. BOAC reckon that the 707 will achieve a break-even passenger load factor on the North Atlantic of about 43 per cent, compared with just over 51 per cent for the Comet 4. This means that the 707 will need between 50 and 60 passengers to break even, while the Comet 4 requires 35-40—a comparison which emphasizes the suitability of the Comet for lighter traffic routes. But because the North Atlantic is not such a route, a comparison between the two aircraft in terms of specific cost is more revealing. Total cost per c.t.m. of the Boeing 707 on the London - New York route is estimated to be 14.2d, equivalent figure for the Comet being 22.4d—an improvement of 37 per cent. (Equivalent cost level of the Britannia 312 is 20.4d.)

The specific operating cost of the 707 thus makes it indisputably superior to the types it is replacing. The figure of 14.2d incidentally includes an allowance for crew training and other overheads involved in the introduction of a new type, and it will probably be reduced as the operation becomes more routine.

The 707 will not be without its problems. The very low specific costs just referred to assume, of course, that the aeroplane is filled—the cargo holds in particular. One recalls BOAC's evidence last year before a Parliamentary select committee:—

"When the corporation has its fleet of Boeing 707 aircraft in full operation across the North Atlantic in 1961 it expects to have 2½-3 times the volume of freight capacity which it now has. . . . The corporation will keep under constant review the freight requirements of the North Atlantic route should all freight support be required there at some future date."

Certainly the 707's freight capacity cannot be carried around

At 39,000ft over the North Atlantic a westbound Comet 4 flashes past an eastbound Boeing 707. The glimpse is fleeting, relative speed of the two BOAC Rolls-Royce-powered jets being over 1,000 m.p.h.

BOAC's 707s are not likely to make frequent refuelling stops at Gander, but calls have been made during proving flights

BOAC ROLLS-ROYCE 707 . . .

unsold. Having made a careful study of the jet's passenger-revenue potential, BOAC concede that 707 freight revenue could just tip the balance between profit and loss in the operation of this aircraft. One of the corporation's problems is to encourage shippers, who generally send their consignments to the airport in the evenings, to change gear and consign in the mornings. BOAC's Boeing 707 departures from London are at lunch time and BOAC are trying to convert shippers to the advantages of a change in their procedures. The corporation has formed a new cargo committee which, as one official describes it, "puts into the same room all the people who can contribute to the expansion of our freight business." Of course, airlines are always claiming that they are giving "top priority to freight;" BOAC say that in their case these words are not as empty as the freight holds they mean to fill.

The 707 seating capacities just outlined were assessed roughly on the principle that traffic on the North Atlantic has now reached the point where 20 per cent is first class and the rest economy class. BOAC's 707 seating configuration follows this pattern, though for the first season it will be biased rather more towards first class. In the 1961 summer season, starting on April 1 next year, the 34 first-class seats will be reduced to 24, and the 97 economy class increased to 111.

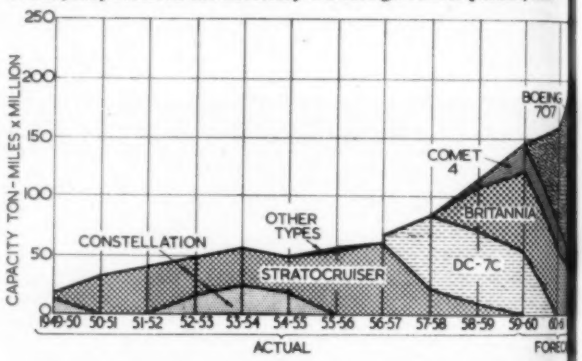
The introduction of the 707 will not mean, as in the case of the Comet 4, that the Britannia 312 will be displaced. Indeed, BOAC visualize work for the turboprop "for a long time to come." They are scheduling the aircraft so that, as a general rule, it will offer an overnight journey both ways between the UK and North America, an attraction to those customers for whom time is not so much at a premium. In addition, there will be the come-on of creature comforts exclusive to propeller aircraft; BOAC's Britannias will have six berths (£30 surcharge) as well as 34 sleeper seats, with a complement of 42 economy-class seats in the forward, less quiet, portion of the cabin. (This Britannia configuration applies to the London - New York direct services; the schedules via Manchester and Prestwick will offer a higher proportion of economy-class seats, the ratio being 16 first class to 75 economy class.) And there is of course a discount for Britannia travel, a differential of about 12 per cent first class and 7½-11 per cent economy class, depending on the season. Will this fare differential, coupled with greater comfort and, in general, overnight schedules be sufficient to attract passengers from the jets to the Britannia? BOAC reckon so.

The advent of the 707 will not diminish the total number of Britannias allocated to the western routes, but the turboprop will be relieved of the New York - San Francisco service by the big jet next October, and at the end of the following month it will take over the Britannia's Pacific route from San Francisco to Tokyo and Hong Kong. All this will release Britannias for other western-routes work at a time when IATA's reduced off-season (October-March) propeller discount fares become available.

Though the 707 will not displace the Britannias, the DC-7Cs will have virtually completed their North Atlantic scheduled-service job for BOAC by the end of this summer. Some will then be available for disposal (though in effect one or two have been on the market for some months at a reaction-testing price of $1 million, and would have been disposed of had there been a bidder). The 707s will displace the DC-7Cs from the US - Caribbean route in the coming winter, operating London - New York - Bahamas - Jamaica, supplementing the Britannia. Next spring the "beyond" Britannia services to Venezuela and Colombia will also be taken over by the 707. BOAC will then have jets linking the US with the Caribbean, a part of the world which is now perhaps ousting Florida as America's favourite holiday playground.

Are BOAC shedding any tears over the decision—which they strongly contested in IATA—to abolish tourist class on the North Atlantic? On balance, no; though they still maintain that there would be a demand for tourist class, and that with its abolition some revenue may be lost. But there is the offsetting consideration of greatly simplified production planning and scheduling. There is no doubt that the people in BOAC responsible for assessing the correct proportions of first class, tourist and economy seats will breathe a sigh of relief when, on July 1, tourist class finally vanishes from the scene.

The so-called polar route between London and Los Angeles, for which BOAC have always been eligible and for which, last month, they received the necessary US foreign carrier permit, has never been operated by the corporation, largely owing to lack of capacity. Now that this will soon no longer apply it is timely to consider whether BOAC intend to put 707s on to the polar route. The corporation is cautiously non-committal. There is a body of opinion in BOAC which considers that the route makes economic nonsense, the only case for doing it being that other airlines, like SAS, TWA, PanAm and Air France, would drain West Coast - Europe business off the North Atlantic route. BOAC are expecting to generate about £800,000 worth of revenue in Los Angeles next year, and a considerable portion of this might be lost to competitors who offer the "non-stop polar route" connection to Europe (which in practice is anything but polar and which more often than not requires a refuelling stop on the eastern seaboard). At the moment it looks as though February or March 1961 may see the inauguration of the 707 polar route if—and it is still a big if—this is indeed considered desirable.



Right, the graph shows the contribution made by the various BOAC fleets to North Atlantic capacity ton-miles over the decade

Left, the familiar "Monarch" trolley (now gold- instead of silver-anodized) in a new and rather more spacious setting. On the left is the manager of BOAC's 707s, Captain T. B. Stoney

Last year about 50 per cent of BOAC's output went into the western routes. This year the percentage would have been considerably greater but for the late delivery of the 707; if all goes well, it should still be rather more than 50 per cent. The corporation is as yet nothing like at full bore on its western routes. Next year (see graph) there will be big increases on figures which, today accounting for half BOAC's effort, are already big. By 1964 it is probable that two-thirds of BOAC's output will be on the western routes. The manager concerned, Ross Stainton, refers to "years of investment on this route at immense cost." But he considers that the corporation is "just about to break into the clear and make a profit." The reason, he says, "is the low cost per c.t.m. of the 707."

On April 28 the US Army successfully launched a Zeus test vehicle from an underground emplacement at White Sands Missile Range, New Mexico. Should Zeus be operationally deployed, underground launching would probably be adopted

Missiles and Spaceflight

THE ANTI-ICBM ZEUS

DURING Project MAN (Modern Army Needs), a three-day presentation by the US Army at Fort Benning, Georgia, many new weapons were seen "in the flesh" for the first time. Not yet properly in the hardware stage, but exhibited in mock-up form, the new Nike Zeus anti-ICBM surface-to-air missile was the greatest single revelation. Superficially it is completely different from its earlier test configurations.

As the two drawings show, the test vehicles betrayed their direct descent from the earlier Nike Hercules. Although their huge boost motor had a single propellant grain and nozzle, they were otherwise virtually a scaled-up Hercules boost. The new configuration is shorter and neater and has fins of lower aspect ratio. But the greatest differences are to be found in the missile itself. The new Zeus profits from the fact that at Mach numbers greater than five it is feasible to dispense with wings entirely. In its revised form Zeus relies on a cruciform of small delta tail fins indexed at 45° to a cruciform of canard control fins of generally similar size. The original test vehicles had rear-mounted delta controls; Hercules had control surfaces mounted along the trailing edges of the delta wings and the original Ajax employed a configuration similar to that of the new Zeus. In addition the missile body appears to have been largely redesigned, and opened out at the rear to give a better aerodynamic and structural joint with the boost.

Like the earlier members of the Nike family, Zeus is being developed by Western Electric, under the direction of the Army Rocket and Guided Missile Agency (a segment of the Army Ordnance Missile Command at Huntsville, Alabama). Major contractors include Bell Telephone Laboratories and Douglas Aircraft, while others heavily committed to the Zeus programme include Goodyear, Remington Rand, Sperry, RCA, North American Aviation, Lear, Thiokol, Grand Central Rocket, Burns & Roe, and Continental Can Co.

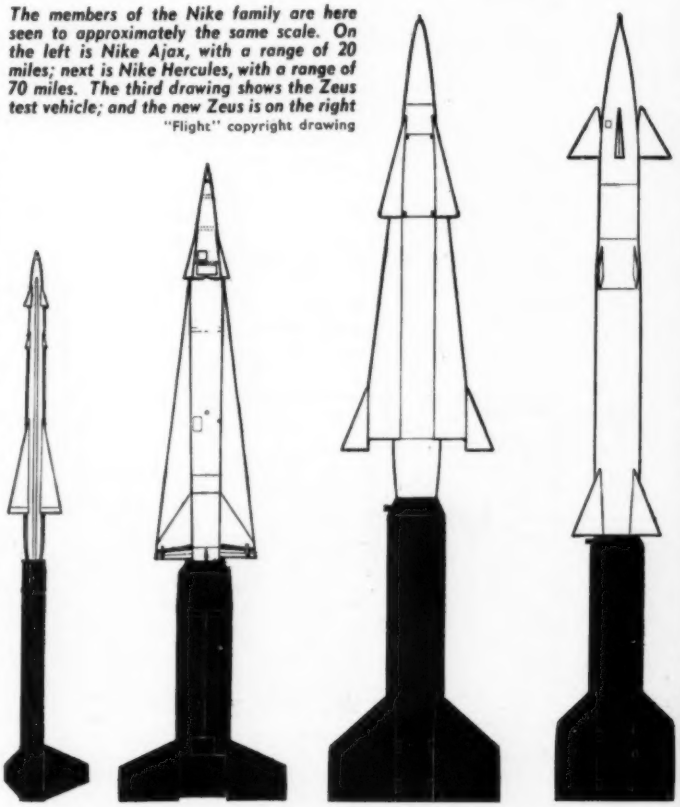
One of the most obvious problems in the development of an anti-ICBM missile is to give it acceleration and performance high enough to reach a height of some dozens of miles in the short time available. Thiokol's Zeus booster has a thrust officially described as "over 400,000lb," conferring a launch acceleration never less than 20g. Grand Central's sustainer is of particularly advanced design, having thin walls, special high-energy propellant and a plastics nozzle developed by Douglas. The other major problem area concerns the fire-control and guidance. An anti-ICBM mission is even more complex and difficult than it might at first sight appear, and at closing speeds of the order of six or seven miles per second, the entire weapon system must operate virtually with no time delays whatever. Major elements of the Zeus system consist of: an acquisition and tracking radar for early calculation of target trajectory; tracking radars for target and missile; an integrated computer which co-ordinates its output with other computers in the system via a high-speed communications network; and a radio/radar link between the missile and the guidance computers on the ground. All this equipment has been designed specially for Zeus, since the original Nike system could meet neither the requirement for extreme tracking accuracy nor rapid computation of data.

The Army Ordnance Missile Command describe the functioning of the system in the following terms. "Within seconds after the approaching ICBM has been picked up by the acquisition radars, a Nike Zeus battery will be automatically assigned to the mission and the missile will be launched. Radars at the launching site will lock-on the hostile missile when it comes within the detection range. The battery computer will then follow the complete action through its radar systems and automatically guide the Zeus missile directly into the path of the oncoming missile. And, at a critical instant, a blast will be triggered, destroying the invading missile warhead. This entire engagement, from detection to destruction of the enemy missile, will take place within 20 minutes, and span activities covering many thousands of miles. The most significant aspect of this defense system is its reliability. The Nike Zeus will function as a fully automated system, free from such mechanical shortcomings and human weaknesses as time-reaction limitations and fatigue."

Full-scale development of Zeus was initiated by the US Army in the spring of 1957. Static firing of the boost motor first took place at Huntsville in 1958, and the sustainer was successfully fired by Grand Central at Redlands, California, last May. The first test vehicle was launched from a special emplacement at White Sands Missile Range last December 16, and four similar vehicles have now been fired from the same ramp. On April 28 a test vehicle closer to the new configuration was successfully fired from an underground launch emplacement at White Sands. Announcing that this firing accomplished all test objectives, the Army added that an underground emplacement would be more resistant to enemy attack, easier to maintain, and—surprisingly—cheaper to build. Two other major Zeus test sites, currently in an advanced stage of construction, have been rendered necessary by the fact that proper Zeus missions cannot be flown at White Sands. The first emplacement consists of a number of launchers and a radar installation at Point Mugu, California. At Kwajalein Island in the Pacific, elements of a complete Zeus battery are rapidly being installed. Missiles fired from here will

The members of the Nike family are here seen to approximately the same scale. On the left is Nike Ajax, with a range of 20 miles; next is Nike Hercules, with a range of 70 miles. The third drawing shows the Zeus test vehicle; and the new Zeus is on the right

"Flight" copyright drawing



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intercept Jupiter IRBMs launched from Johnston Island, 1,650 miles to the east.

Owing to its immense size and complexity, no decision has yet been taken to deploy the Zeus system operationally. However, the mere fact that it is the only defensive system in the Western world capable of offering protection against hypersonic vehicles is enough to ensure that the programme continues to be funded at a high rate. According to our contemporary *Aviation Week* it is widely believed that the entire system could be operational two years from now.

MANNED SPACE STATIONS SYMPOSIUM

Regardless of the magnitude of scientific advances realized, or even contemplated, with contemporary flight systems, it is characteristic of mankind to inquire, "What comes next?" Such was the case at the Manned Space Stations Symposium conducted recently by the Institute of the Aeronautical Sciences in Los Angeles. America's Project Mercury effort (described in *Flight* of February 12 last) is not expected to place a man in orbit until some time next year; and yet, listening to the ambitious futuristic programmes proposed and discussed at this meeting, one might easily have concluded that details of Project Mercury should be reported in *Flight's* "Retrospect" feature.

Beyond the Dyna-Soar vehicle, Col Lowell B. Smith (chief of the space systems office at the USAF Wright-Patterson Field) foresaw the need for a military test space station. Noting that in actual practice it was difficult to differentiate between pure scientific research and military research and development, the colonel envisaged two broad missions for the space station. The first would be the collection of fundamental scientific data. Secondly, the station would serve as a platform on which to determine the effects of a space environment on personnel, mechanisms and weapons. The military station offered the opportunity to gain exposure to unattenuated cosmic and other forms of extraterrestial radiations for extended periods of time. The science of astronomy (which was to be discussed in detail in another later paper) also would benefit, and undistorted celestial observations would assist subsequent exploration of our solar system and galaxy. Space also provided an ideal vacuum chamber in which to perform tests of equipment to be used in future exploratory work. Scientific probes might be launched from the station, and the orbiting laboratory could be used as a staging base for lunar and planetary missions. Being a lonely, remote test site, the station could be used for advanced weapons tests, the conducting of which on the Earth might contaminate the terrestial atmosphere.

When might such a station become operational? All factors considered, the colonel concluded that 1972 was a realistic date. The next two or three years would be occupied by study work. A further 5-7 years of development was foreseen, followed by a "first flight" in 1970. The system would be fully operational two years later.

Two Lockheed scientists, Kramer and Byers, discussed *A Modular Concept for a Multi-Manned Space Station.* The speakers detailed a 94ft wide, 108ft long station which was to orbit at an altitude of 318 miles. Modular construction techniques were employed, the vehicle being assembled from a collection of spherical and cylindrical units. Each sphere was 18ft in diameter, while the cylinders were shown as 10ft in diameter and 30ft long.

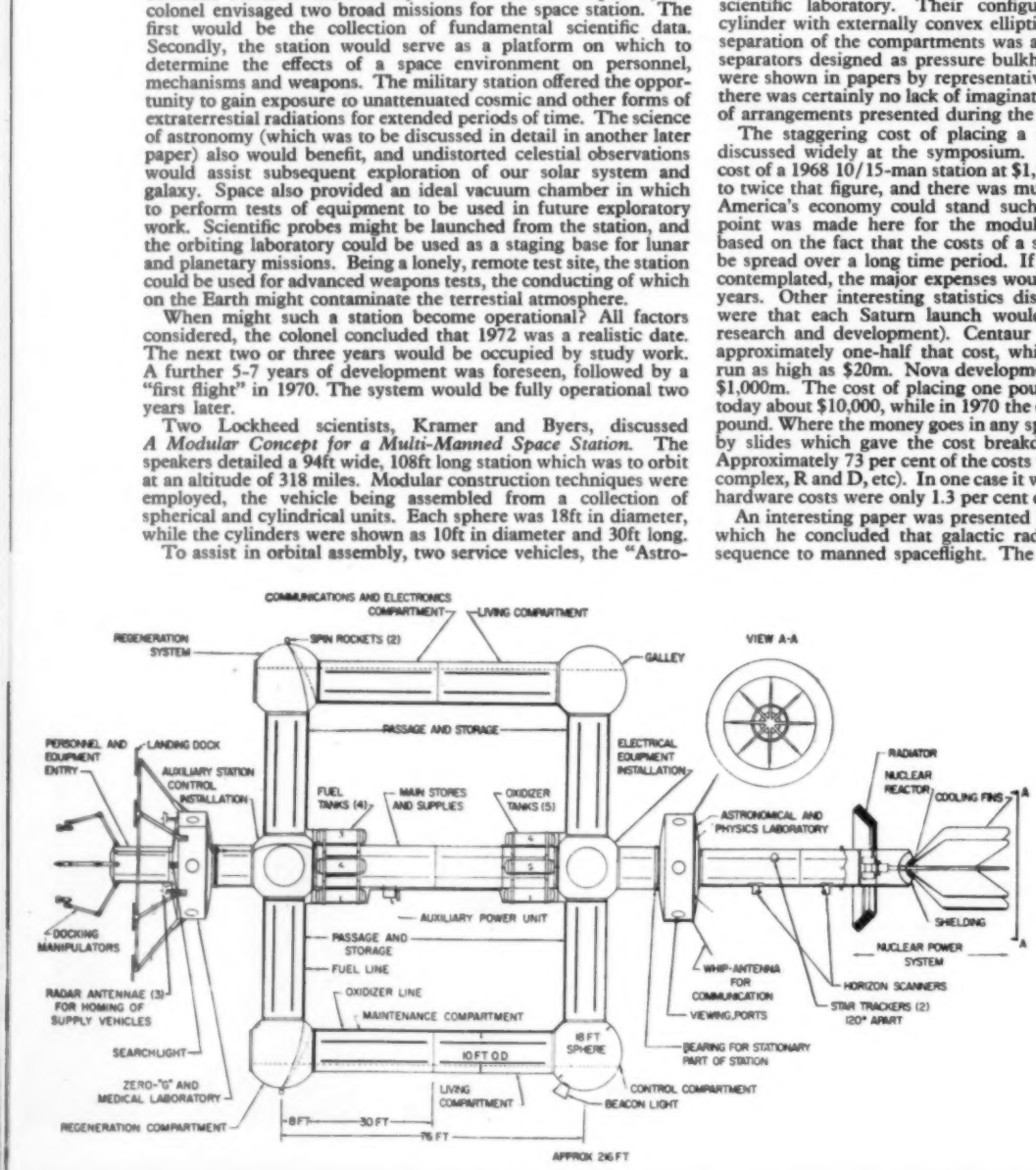
To assist in orbital assembly, two service vehicles, the "Astrotug" and the "Astrocommuter," were conceived. The Astrotug was to serve as a "spaceborne workhorse"; the other vehicle could re-penetrate the Earth's atmosphere and was to be utilized to carry cargo and personnel to the station. The station was to spin about its own axis to provide a one-g environment (due to centrifugal force) in the outermost modules. Modular techniques (as opposed to unitary construction) were favoured because the failure of any one cabin would not prove catastrophic. Better growth potential was another reason for choosing a building-block approach rather than a single large vehicle. The station would weigh slightly more than 440,000lb and use a nuclear reactor as a primary power-source. In case of temporary reactor disablement, a secondary bi-propellant-operated two-cycle piston engine would be used for emergency power.

Several interesting effects were expected from the coriolis forces incurred because of the station's rotation about its own axis. While walking across the cabin in the direction of rotation, the crew would experience a downward force. For example, the loads would tend to press one's head against one's chest. Walking in the opposite direction (against rotation) would tend to produce upward forces which raised one's head. In climbing a ladder towards the centre of the station, the crew would experience sideways forces in the direction of rotation; while, in descending, opposite side forces would be experienced. Coffee poured from a container would not fall directly, but would appear to fall at an angle with respect to the vertical. These coriolis effects were expected to produce a somewhat distressing environment for the spaceman; tests conducted on a "slow centrifuge" on Earth under simulated orbiting conditions had caused nausea among the men, and acclimatization to the unusual conditions proved difficult.

Several members of the Martin Company described a 4/6-man scientific laboratory. Their configuration was a pressurized cylinder with externally convex elliptically-domed ends. Interior separation of the compartments was achieved by the use of floor separators designed as pressure bulkheads. Other configurations were shown in papers by representatives of other companies, and there was certainly no lack of imagination displayed in the variety of arrangements presented during the meeting.

The staggering cost of placing a space station in orbit was discussed widely at the symposium. Some estimates placed the cost of a 1968 10/15-man station at $1,500m; other guesses ranged to twice that figure, and there was much questioning on whether America's economy could stand such a momentous venture. A point was made here for the modular theory of construction, based on the fact that the costs of a space station could thereby be spread over a long time period. If a single large vehicle were contemplated, the major expenses would be concentrated in a few years. Other interesting statistics disclosed during the meeting were that each Saturn launch would cost $10m (exclusive of research and development). Centaur shots were expected to be approximately one-half that cost, while each Nova firing might run as high as $20m. Nova development costs were estimated at $1,000m. The cost of placing one pound of payload in orbit was today about $10,000, while in 1970 the cost might drop to $100 per pound. Where the money goes in any space programme was shown by slides which gave the cost breakdown for a typical project. Approximately 73 per cent of the costs were non-recurring (launch complex, R and D, etc). In one case it was noted that actual vehicle hardware costs were only 1.3 per cent of total programme costs.

An interesting paper was presented by Dr James Van Allen, in which he concluded that galactic radiation was of minor consequence to manned spaceflight. The most serious problem was



The proposed Lockheed space station, suggested by Kramer and Byers at the Los Angeles Symposium reported above, would employ modular construction techniques, the vehicle being assembled from a collection of spherical and cylindrical units. The 108ft-long station would weigh over 440,000lb and would orbit at a height of 318 miles

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that of solar flares, which had been observed to occur about once a month. Lasting about one day each, the flares produced between 20 and 1,000 times the galactic intensities. The occurrence of flares was extremely difficult to predict, and less than 10 per cent of solar disturbances developed into fully-fledged flares.

Results from the latest series of space tests, according to Dr Van Allen, indicated that the inner radiation belt was quite stable in intensity. Less than 20 per cent variation had been detected thus far. In contrast, the outer belt appeared to vary by a factor of perhaps 10,000. Spaceflight below 400 n.m. altitude was relatively safe between the 40 deg latitudes, but it was "unthinkable" that man could orbit within the inner radiation belt. "Sweeping out" the inner belt, as proposed by one of Dr Van Allen's colleagues (Dr Singer), seemed hopeless to the speaker. Shielding against the inner belt's radiation also appeared hopeless. Solar cells, used by many vehicles for a power supply, had a lifetime of only a few months in this belt. The speaker ventured that all planets probably had radiation belts.

Contrary to the theme of the meeting, which was "manned" space applications, Dr Nancy G. Roman, chief of the NASA astronomy and astrophysics programmes, cited several reasons why she did not want occupants aboard orbiting astronomical observatories. Obviously, a man moving about in a vehicle created disturbances, but even if there were no perceptible movement, man could still not be tolerated. Breathing, and even the angular momentum of blood circulating through man's body systems, caused unacceptable effects. Dr Roman made out a case for satellite stabilization to 0.01 sec of arc, an extraordinary requirement by today's standards, where satellite stabilization to an accuracy of less than one degree is considered good.

And why should we place an observatory (or telescope) in orbit? There were many reasons. The atmosphere which surrounds the Earth atenuates all but the strongest light and radio waves. Ultraviolet emissions were almost all absorbed by the atmosphere. Furthermore, it was just about physically impossible, due to gravitational forces, to construct a mirror larger than 200in in diameter. Ultimately, Dr Roman suggested, there was a use for a 100ft diameter reflector in space. The 12in telescope in the Project Stratoscope (high-altitude balloon) experiment had produced finer pictures of the Sun's surface than had ever been obtained with the largest ground-based telescope. A wealth of extremely useful information would hence be obtained by the Orbiting Solar Observatory (OSO) later this year, and by the Orbiting Astronomical Observatory (OAO) programme within the next three years.

PIONEER 5 SWITCHES UP

The higher-powered (150W) of the two radio transmitters aboard the US space probe Pioneer 5 was brought into use for the first time at 10.04 a.m. GMT on May 8 at a distance of approximately 8.001 million miles. The command signal was sent from Manchester University's experimental station at Jodrell Bank, using the 250ft steerable radio telescope.

Since its launch from Cape Canaveral on March 11, Pioneer 5 had been telemetering scientific information daily by means of a five-watt transmitter. On May 7 it became apparent that this unit had almost reached its transmission limit, and it was decided to attempt to energize the 150-watt transmitter.

This involved a three-step sequence, beginning with a signal from Jodrell Bank at 10 a.m. which directed electrical power into valve filaments through a current-limiting resistor, in order to warm up the filaments for about one minute. Six hours later this was repeated and a second command was sent which removed the resistor from the circuit and supplied full filament heating for several minutes. The final command was sent at 10.03 a.m. on May 8, energizing the 150-watt transmitter and its electrical converter. The unit measures 7in × 5in and weighs 5lb.

Because of the high power-drain imposed by the 150-watt transmitter, it is being operated only for some 2-3min every 6-8hr. Jodrell Bank can receive data at the rate of either eight or 64 items per second. Power for the probe comes from 4,800 solar cells, the output from which constantly charges 28 chemical batteries, which in turn power over 40lb of experiments, electronics, a receiver, transmitters and associated logic units.

A statement by the National Aeronautics and Space Administration on May 8 reported: "At this time it is impossible to predict how long the spacecraft will continue to relay information. In recent weeks a minor component failure has been noted and compensated for. Also some slight deterioration in the batteries has been observed, possibly the result of leakage in the vacuum of space . . .

"To date the probe has returned more than 109 hours of data on cosmic radiation, charged-particle energies and magnetic-field phenomena. In two short months, the probe has overturned well-entrenched theories about solar-flare effects and the extent of the Earth's magnetic field."

THE THOR RECORD

Statistics published by Douglas Aircraft Co, Santa Monica, on May 6 indicate that, in terms of usable payload weight, Thor boosters have supplied the "initial push" for 88 per cent of the payload weight placed in orbit by the USA. Thor had "functioned flawlessly," the company stated, in 24 of its 28 assignments as a space vehicle booster. An analysis of the USA's 22 successful space shots showed that these had used 12 Thors, six Jupiter Cs or Junos, three Vanguards and one Atlas as first-stage boosters. "An impressive degree of reliability and versatility," according to Douglas, had been demonstrated in the total of 90 Thor firings, of which 62 were military and 28 were space launches.

BLUE STREAK AFTERMATH

In the annual report of the de Havilland Enterprise, Sir Aubrey Burke states that the group as a whole spent some £16m on Blue Streak in the four years that they worked on it. During the past year, he said, the programme had "progressed most satisfactorily." In Canberra on May 11, the Australian Minister for Supply, Alan Hulme, said that the total amount spent on the programme in Australia was about £A11m (£8.8m), but he could not say how this sum had been shared between the two countries.

Guidance contractor was Sperry Gyroscope, and even if development of the basic vehicle is continued as a booster for spacecraft their excellent inertial system is unlikely to be required. On May 9 Sperry told some 200 employees at the Bracknell, Berks, plant that they would be laid off on June 3.

DAVY CROCKETT

Basic information on this miniaturized tactical nuclear delivery system were contained in our missiles review of November 6 last. The actual launcher has now been exhibited publicly (during Project MAN, mentioned at the head of page 679). A few years ago the smallest nuclear weapon weighed several hundred pounds and occupied a volume of many cubic feet; in fact the original Hiroshima "bomb" could only just be carried by a B-29. The almost incredible progress by the US Atomic Energy Commission in reducing the minimum size and weight of nuclear weapons has now enabled tactical devices to be fired from a launcher which can be transported by infantry. The Davy Crockett shell was not shown at Fort Benning, but observers have suggested that it has a calibre of 5in and a length of about 30in, suggesting a weight of about 50lb.

The launcher consists of a mortar-like tube, hinged near its muzzle to a folding, triangulated mounting which can be erected on any fairly firm terrain. Tied in with the launching tube is an optical sight. One-tenth the weight of previous recoilless systems, Davy Crockett fires its shells—atomic or conventional—by means of a propulsive charge and launching piston, a rearwards-facing nozzle providing the counterbalancing thrust. One would not expect the range to be greater than three or four miles.

Titanium Metals Corporation of America commented that most of Davy Crockett's structure is fabricated in heat-treated titanium, thereby achieving a weight-saving of 80lb. Other advantages of this material are that the weapon is immune to corrosion and that it can operate between minus 65° and 125°F with virtually no attention. There are three major thread-jointed parts, and the barrel is heat-treated to a strength of 210,000lb/sq in. Davy Crockett production is expected to consume 2,000,000lb of titanium over the next five years.

Davy Crockett was designed by Frankford (Pennsylvania) Arsenal, and its launching piston and ammunition by Picatinny (NJ) Arsenal. Prototypes are being made by Watervliet Arsenal, who will supervise subsequent production by industry. The Army Ordnance Corps is at present engaged in intensive trials with Davy Crockett at Aberdeen proving ground.

An Atlas ICBM fired from Vandenberg AFB on May 6 was destroyed by ground command when it developed a fault at about 5,000ft.

During May HMS *Girdle Ness* is engaged in a series of firing trials off Malta of "production" Seaslug ship-to-air missiles. The configuration of this weapon was revealed in our issue of April 29.

United Aircraft have reconstituted their Missiles and Space Systems Division as part of Hamilton Standard. The MSS Division has never had manufacturing potential, and the new move is expected to put it on a firmer footing.

In recent weeks Polaris has been subjected to some sniping, especially from the USAF. Defending the fleet ballistic missile system, the US Navy Secretary said on May 6 that the suggestion that Polaris submarines cannot defend themselves was "a hollow fear"; they had detection equipment and anti-submarine torpedoes. Moerover, the accuracy of Polaris promised to be "as good as that of any known missile."

Further to our photograph of the tethered launching of a Minuteman on May 6 published last week, additional information has come in on this firing. It was the last silo test at Edwards AFB, and was completely successful. The three-stage missile had only a small propellant charge in its first stage. After leaving its silo cleanly the vehicle rose to about 120ft and the first stage fell about 300ft down-range.

FLIGHT SYSTEM SURVEY

Britain Accepts DMET

FROM an exchange of questions and answers in the House of Commons it appears that Britain has decided not to challenge the ICAO standardization of DMET. While agreeing that the ICAO decision might not have been wise or technically justified, Duncan Sandys, Minister of Aviation, stated that Britain could not risk breaking up the ICAO organization by refusing to accept its ruling and "going it alone" with another aid. He did, however, add that a system like Decca would be necessary for the European traffic control system which is now coming into being and that other European countries expressed "a good deal of common feeling." Britain would continue, in the interests of safety, to urge the need for a course-tracing system on the Decca principle, particularly in areas of high density.

BOAC Evaluates Marconi Doppler

UP to March 1 this year BOAC had flown some 4,000hr on the Far Eastern routes with a Marconi AD.2300 Doppler navigator, first without and then with a computer. Performance of the equipment during the first 650hr was recorded and analysed in detail and showed good performance over both land and sea. Records show that on the great majority of occasions when the equipment reverted to memory operation the time involved was not operationally significant. Carefully recorded flight with the computer showed 95% probability errors of +0.5% to −3% along track and about ± 2.5% across track after flying over sea and ±3.5% across track and ±1% along track over land. Lengths of measured legs varied between 200 and 1,260 n.m.

From these trials BOAC feel that they have obtained positive information on Doppler performance over calm-water routes and about the range of drift angles to be encountered and the fine-grain structure of winds. They also know what order of accuracy they can obtain with the gyro-magnetic compass which at present forms part of the system. Excellent recordings were also obtained of the random changes of wind with altitude, providing a better understanding of the problem of making closely controlled descents from jet altitudes. Wind transients have been found with a duration of about 10sec and rates of change of drift which have on at least one occasion exceeded 5°/sec. BOAC say that these are significant and should be treated with due respect. Great caution would be required in coupling Doppler drift to the autopilot.

Contracts for Automatic Landing

THE FAA has placed a $126,668 order with Lear for modification of an L-5 autopilot and provision of a computer to enable an aircraft to make experimental automatic landings using the Gilfillan Regal system. Installation in an FAA aircraft is to be completed in mid-July at the Lear Astronic Division factory at Ontario, Calif. The trial Regal installation is at Atlantic City.

Narrow-gauge, centreline, approach and high-speed turn-off lighting on the 8,400ft 4L-22R instrument runway at New York International. Instrument runways at La Guardia and Newark airports are parallel to facilitate control and approaches are made over water. This is the first commercial runway to have the narrow-gauge lighting designed to overcome "black hole effect"

Ferranti Airpass in a Lightning. This aircraft will be capable of accommodating Airpass II, some details of which are given below

The US Navy has placed a $4.3m order for Bell Aircraft AN/SPN-10 precision radars to be delivered in eighteen months' time and to be installed in three aircraft carriers and at one shore station. This equipment is similar to the radar Automatic Landing System now being evaluated by FAA, but it will initially be used only for automatic precision approaches and will include computers capable of predicting ship's motion. The twin aerials will be mounted on the carriers' superstructure and visual displays as well as approach-path computers will be provided. More than 100 fully automatic carrier landings were made on *Antietam* some time ago. This will be the second automatic landing system to go into service, BLEU's Autoland being the first.

Private-venture Airpass II

Now being designed as a private venture by Ferranti in Edinburgh, Airpass II uses the attack sight and other parts of the RAF Airpass I fire-control. It is intended as a dual-purpose interception and ground-attack system suitable for either single- or two-seater aircraft and should meet foreign requirements.

Main functions of Airpass II are air search and automatic target tracking, computer-controlled approach for blind or visual attacks with a variety of air-to-air weapons and radar-assisted attacks against surface targets with a variety of weapons. In addition, Airpass II is being adapted for navigation and low flying and may be used for ground mapping, contour mapping with warning of obstacles ahead and an indication of the best way round them and terrain clearance with steering signals displayed in the attack sight permitting a chosen course to be followed and any hills cleared in the optimum manner. Airpass II is hardly heavier or more difficult to operate and maintain than the Mk I. It has been specified for the export versions of the Lightning, Mirage III and Draken.

ANIP for Civil Use

LAST week we described in these columns the important new Para-Visual Director first described by Smiths at the recent 13th IATA technical conference in Lucerne. At the same meeting, the Douglas Aircraft Co suggested the use in civil airliners of the television flight director system using the "highway" track guidance method being developed under the Army-Navy Instrumentation Program managed by Douglas. In a civil airliner, Douglas suggest, the ANIP system would present on a transparent television screen in front of the normal windscreen a moving pathway along which the pilot could fly in simulated visual flight. Beneath the screen would be a map display showing the position and track of the aircraft, location of obstacles and the computed range capability of the aircraft with fuel load remaining at any moment. The displays would be generated by a contact analogue computer, based on "sub-miniature" circuitry, which would integrate all information and senser inputs for the pilot.

The ANIP would probably have to be designed as part of an aircraft, but flight tests of early equipment have shown significant simplification of instrument flying. The broader control principles worked out under ANIP have already been applied to submarine and ship control, but application to aircraft is not foreseen for some years.

Improving the Breed

GLOSTER'S BIG JAVELIN CONVERSION PROGRAMME

LAST week we were invited by Gloster Aircraft to see something of their work in the conversion of Javelin FAW.7 fighters to FAW.9 standard. At the same time we were able to learn some of the problems which have faced this famous company, and to hear how they are being solved.

The visit took us to Moreton Valence; but the company still have their main offices at their traditional HQ at Hucclecote and retain a small facility at Brockworth. All these locations are, of course, close to the city of Gloucester. For a considerable period Gloster's aircraft-manufacturing capacity has been over-large and so other members of the Hawker Siddeley Group—such as Hawker Siddeley Brush Turbines—have occupied surplus plant, and other areas are engaged in "diversification" activities. The latter are extremely successful, and embrace such products as farm machinery and automatic vending equipment.

Nevertheless, some 750,000 sq ft remain on aircraft work. The last Javelin FAW.8 (the last aeroplane which the company will make) comes off the line next month, but the conversion programme will remain in full swing until July 1961, and the several hundred Javelins of Fighter Command and 2nd TAF will continue to provide spares, modification and repair business for a much longer period. It is appropriate here to note that recent fatigue testing has demonstrated that the Javelin has an airframe life far in excess of the original calculated figure. For a considerable period components and spares have been manufactured in support of Avro's Vulcan, Shackleton and Blue Steel and for the D.H. Comet, and the design office is hard at work on the AW.660, Avro 748 and D.H.121.

At Moreton Valence some 700 personnel are engaged in the repair and overhaul of RAF Javelins and in the modification of Mk 7s to Mk 9 standard. As each Mk 7 is received it is subjected to a major check, and the powerplants (Bristol Siddeley Sapphire 7s), ejection seats and dangerous items are removed. The airframe is then broken down into major components which, after distribution among a number of shops, are further broken down to enable the fullest use to be made of manpower in what otherwise would be restricted and cramped areas. In the fuselage shop structural modifications are made and the new systems installed, after which the complete assembly is passed next door and the mainplanes put on. The latter are provided with a revised and slightly drooped outer leading edge. Although the powerplants are virtually unchanged, the jetpipes are equipped with a variable-area nozzle and simplified reheat is added, giving an improved performance envelope (the reheat and new leading edge together confer greatly increased ability to perform manœuvres at altitude without losing either speed or height). After roll-out the new Mk 9 has all its systems checked during about 1½ days of engine running. Since Easter, a Detuner installation has cut maximum noise from this work to below 80db. Back in the hangar the aircraft is examined by Gloster and AID inspectors, and finally leaves after an average of about five test flights.

It is perhaps worth adding a note about the three latest marks of our standard all-weather fighter. The FAW.7 introduced the Sapphire 7 engine of 11,000lb dry thrust. This mark was also the first to carry the D.H. Propellers Firestreak air-to-air missile, four of which are hung on underwing pylons. The associated aircraft-mounted units of the system are carried in the fuselage. A British radar set is fitted, and the rudder is provided with a yaw damper. The FAW.8 was the first mark to have the Sapphire with limited reheat, giving 12,390lb thrust, and other equipment includes American radar equipment, drooped leading edge, dampers on both yaw and pitch axes and a Sperry autopilot. The Mk 9 is essentially the Mk 7 converted to Mk 8 standard, differing from the 8 in having a British radar. At present Gloster are not installing an autopilot in the Mk 9 aircraft, but all are being equipped for flight refuelling, for which purpose a huge fixed probe can be attached high on the starboard side of the forward fuselage.

COMMEMORATING HENDON AERODROME

TO mark the 50th anniversary of the opening of Hendon Aerodrome (originally the London Aerodrome) an exhibition is now being held at Church Farm House Museum, Church End, Hendon, London NW4. It continues until August 31.

Mainly photographic, the contents record the growth of the aerodrome from pioneer days before the First World War, when Louis Paulhan flew from Hendon to win the £10,000 *Daily Mail* prize for a London - Manchester flight, to the present time. Models of aircraft which flew at Hendon in pre-World War One years have been made by the Mill Hill and District Model Aero Club, and trophies awarded for races in those early days have been lent by the RAeC. The exhibition is open on weekdays (except Tuesdays) from 10 a.m. to 12.30 p.m. and from 2 p.m. to 6 p.m.; on Tuesdays from 10 a.m. to 1 p.m.; and on Sundays from 2.30 p.m. to 6 p.m. Admission is free.

The first flying at Hendon took place when E. I. Everett, a director of the Colindale firm of Everett, Edgecumbe & Co Ltd, built and flew his own aircraft from a temporary shed on a field between the Midland Railway and Edgware Road. In December 1910 Claude Grahame-White acquired the field from which Paulhan had started his flight to Manchester, and with his friend Richard T. Gates began to clear the ground for what was later to become the London Aerodrome, Hendon, where the Grahame-White Aviation Co was formed (in 1911) and a flying school established. Hendon was famous for its air pageants in inter-war years; the King's Cup Air Race originally started there; and the aerodrome was used by the SBAC for its annual show between 1932 and 1936. Fighter aircraft were based at Hendon early in the Second World War and it is still an RAF station, though flying came to an end there a year or two ago.

Straight and Level

BEA has made a profit for the sixth year running. It is a record one—about £2m net. How do they do it when they run one of the shortest-stage networks of any other carrier of comparable size? I thought short-haul stages were economically the most difficult to make pay. But if this is true why can't BOAC make profits with their essentially long-haul operations?

I think the answer lies not so much in the economics of stage length. Flipping through the last BEA annual report for a bit of information the other day I came across the following:—

"It is customary in annual reports for the board to express its appreciation of the loyalty and hard work of its staff. We wish that there were some way in which we could make it quite clear that our words on this subject are much more than conventional expressions. For it is with deep sincerity that we say that the skill, dedication and general spirit of our staff are our greatest assets. All who know BEA will agree that it is welded together by strong bonds of comradeship and inspired by good humour. One infallible indication of the strength of an enterprise is that its employees are proud to work for it. By this test BEA has nothing to fear."

Nearly all of BEA's top executives have been with the corporation for 16 years. This may account for it.

● In an issue which has quite a few pages devoted to light-aircraft affairs, let's spare an incidental thought for the efforts of two of the organizations which claim to represent large sections of the light-aviation movement. The Royal Aero Club, we know, has organized the Business and Touring Aircraft Competition at Shoreham, and a jolly good thing it is, too. The Association of British Aero Clubs has organized a Summer Convention at Thorney Island, and a jolly good thing that is, too.

But now let's look at the dates. Shoreham, May 20 and 21; Thorney Island, May 21. I should like to ask Mr Stephenson of the Club and Mr Miles of the Association two questions: why this unnecessary duplication on a not-particularly-crowded calendar, and when are the two organizations going to stop this stupid squabbling and start to co-operate?

● In spite of the magnificent furore over the cancellation of Blue Streak, I am delighted to learn that our deterrent is so secure. According to Mr Watkinson, who as Defence Minister ought to know, we need not worry at all. First we have the V-bombers, with Blue Steel (pity Blue Steel Mk 2 has been cancelled just when it was getting going; but can't be helped). Then we have Sky Bolt (pity it isn't ours and isn't here yet; but the Americans are good chaps). Then, if Sky Bolt fails, we have Polaris (well, we intend to do a study to see how difficult and costly it would be to have it by 1970). Then, by the knowledge gained in the Blue Streak programme, we could do our own solid-fuel ICBM (pity the USAF is doing Minuteman, which we could only duplicate). Pity.

Whether or not you would like to float around at 6,500ft in one of these laundry baskets, as a *Flight* colleague did a fortnight ago, you must admit the street-sign is appropriate. The city is Rotterdam, and the occasion the recent international balloon race

● I have never ceased to be intrigued by the manner in which our elected representatives at Westminster conduct debates into aeronautical matters. Members seize upon something and proceed to beat it to death from all points of the compass, without noticing that the point at issue is either trivial or buried in the limbo of history. I have long wished an air-minded schoolboy could be given a parliamentary post as advisor on aviation affairs.

Even in the debate on the Britannic, in which security played no part at all, it is strange that much of the time seems to have been taken up by a point-by-point comparison between that aeroplane and the various types of Lockheed C-130. The only mention of the Douglas C-133 consisted of the words "there is the C-133 Douglas Cargomaster . . ." The implications of the Franco-German Transall C.160 seemed to have escaped everyone's notice, and the CL-44—already accepted as the optimum long-range, high-capacity freighter for the airlines—was also not mentioned. Incredibly, the Swift was—but at least we were spared the Princess and Brabazon.

● Readers who live near London Airport will not have missed the significance of a paragraph ("Press on Sans Regard," page 667 last week) about Swissair's new Caravelle timetable. Quite clearly, this is the break-through; from May 24 jets other than the Comet will be taking off and landing at London Airport during "sleeping hours." On June 2 Swissair's jets will be joined by those of SAS. The Ministry of Aviation spokesman said subsequently that the Caravelle would have to undergo noise tests before permission was granted to operate between 11 p.m. and 7 a.m. Would they be similar to the tests undergone by the Comet? Yes, probably they would. What were the tests that the Comet was subjected to before it was cleared for night operations? "I am sorry, but I really can't go into that."

Three weeks ago I said that the noise-measurement tests to which the Comet had been subjected were a Ministry secret. I make no apologies for raising the subject again; they are still secret and, even more disturbing, it seems that the tests to be applied to other jets are to be kept secret also. And if the test conditions are secret then the results—whatever decibel figures may be given—remain secret too. Aurally, this might be just tolerable in the case of the Comet 4B, but my own noise-measuring devices tell me that for London Airport residents it won't be so good with the Caravelle, and that with the Tu-104, Boeing 707 and DC-8 this secret will be a very unsatisfactory one indeed.

● Every now and then a misprint appears in a handout and brings pleasure to an otherwise routine working day. Such a one occurred in Hunting Aircraft's description of the Provost when they announced the delivery of the 461st and last of this line of trainers to the Irish Air Corps. They stated that official RAF armament trials had shown the aircraft to be "an exceptionally stable fun platform."

This note of whimsy provides a most charming valediction. One can imagine the last Provost, in its Irish markings, sailing along with leprechauns gaily dangling from its wing-tips, while its two-seater cockpit is crammed with joyous little people off for an aerial outing, to see whether the mountains of Mourne really swape down to the sea.

● A museum-piece bequeathed by *Flight's* editorial ancestors is a handy little volume of 2,620 pages, *Webster's New International Dictionary, 1911*. Though we do possess rather more up-to-date reference works, somebody wondered if it would help him to define "sonic," as used of the Victor in a current hand-out.

"Sonic," it said "—see Petrography." Now petrography is the science of classifying rocks, and under this heading he found: "Sonic, of the nature of, or containing, sodalite or noselite; —contrasted with nelic." I have long sympathized with technical translators; I can see it now—"The Victor, which contains a noselite . . ."

ROGER BACON

The Shoreham Tournament

Based upon an Ordnance Survey map with the sanction of the Controller of HM Stationery Office, Crown copyright reserved

AT a time when business flying in Britain is at last beginning to mean business, the Royal Aero Club's Business and Touring Aircraft Competition at Shoreham Airport is a significant and appropriate occasion. The phrase "air touring," also, has come in recent years to mean more than the occasional there-and-back trip to the coast. In the effective use of light aircraft, this country is beginning to grow up.

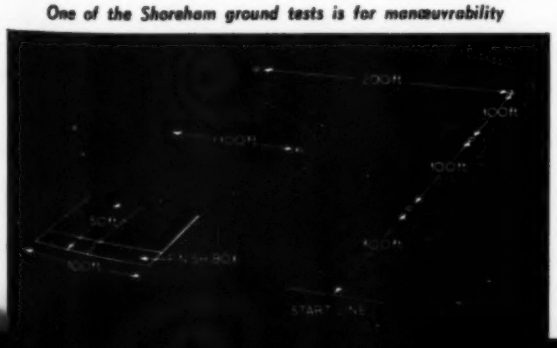
The meeting will provide a marked contrast to the last air touring contest organized by the club, which attracted a modest entry of 13 aircraft at Cranfield in 1954. On that occasion a 200-mile course was flown, with points awarded for navigation, speed, and fuel economy, and the winner was Pat Fillingham in a Hornet Moth. This year's event has royal patronage, with John Severne flying a Garland Linnet entered by the Duke of Edinburgh; and the main battle will undoubtedly be between the Cessna and Piper "works teams" of modern and efficient US machines. Both company teams have entries in all three contest classes.

No arrangements have been made to cater for members of the general public who wish to view the competition, which is regarded by the Royal Aero Club as a private meeting. There will be a visiting aircraft park at the aerodrome, but prior permission must be obtained by visiting pilots before landing during today and tomorrow (Friday and Saturday).

Some of the reasons for the contest are discussed in a leading article on page 673. In this six-page section the contest regulations are outlined, the competing pilots are listed and their aircraft illustrated, and some of the factors on which the results depend are detailed.

The aircraft entered for the competition (see accompanying list) are grouped in three categories: (1) single-engine touring aircraft having one or two seats and a gross weight not exceeding 2,204lb (1,000kg); (2) single-engine business and touring aircraft with more than two seats, or exceeding 2,204lb gross weight, but not exceeding 12,500lb; and (3) multi-engined business and touring

One of the Shoreham ground tests is for manœuvrability



THE ENTRIES

No.	Entrant	Pilot	Aircraft
	Class I		
1	The Air League	Air Cdre G. J. C. Paul	Turbulent
2	Rollason Aircraft & Engines Ltd.	N. H. Jones	Turbulent
3	D. R. Robertson	Entrant	Moth Minor
4	P. G. Statt	D. R. Stuart	Moth Minor
5	C. Gregory	Entrant	Taylorcraft
6	Vigors Aviation Ltd	B. J. Snook	Super Cub
7	HRH the Duke of Edinburgh ...	Sqn Ldr J. Severne ...	Linnet
8	J. O. Hodgson	Entrant	Tipsy Trainer
9	Rollason Aircraft & Engines Ltd.	Miss M. McKellar ...	Hornet Moth
10	P. Q. Reiss	Entrant	Hornet Moth
11	Vigors Aviation Ltd	Wg Cdr T. C. Murray	Super Cub 150
12	Rollason Aircraft & Engines Ltd	D. McDonell Hartas ...	Jodel D.117
14	Airwork Services Ltd	—	Cessna 150
15	Airways Aero Association ...	P. W. Brooks	Chipmunk
16			
17			
18	P. G. Masefield	Entrant	Chipmunk
19	J. E. G. Applevard	Entrant	Chilton
	Class II		
20	Miss S. Scott	Entrant	Jackaroo
21	J. Stewart-Wood	Entrant	Auster 5
22	N. A. L. Thorne	Entrant	Auster 5
23	P. B. Cash	Entrant	Messenger
24	J. Dougherty	Entrant	Meta-Sokol
25	W. J. D. Roberts...	Entrant	Meta-Sokol
26	R. W. Kenny	Entrant	Meta-Sokol
27	The Earl of Bective	Entrant	Prospector
28	K. Rutter	Entrant	Prospector
29	Vigors Aviation Ltd	J. Youall	Caribbean
30	H. Best-Devereux	Entrant	Wassmer Super 4
31	Vigors Aviation Ltd	Flt Lt P. Austin ...	TriPacer
32	Autair Ltd	M. D. Parry	Helio Courier
33	Airwork Services Ltd	R. H. McIntosh ...	Cessna 175
34	J. C. C. Taylor	Entrant	Proctor 1
35	H. W. Gray	Entrant	Proctor 5
36	Rollason Aircraft & Engines Ltd	C. P. Francis	Jodel D.140
37	D. Jackson	Entrant	Monarch
38	Vigors Aviation Ltd	J. Fricker	Comanche
39	Airwork Services Ltd	G. Knox	Cessna 210
	Class III		
40	"Flight"	M. A. Smith	Gemini 3A
41	Dulmison Aircraft	—	Aero 145
42	Dulmison Aircraft	—	Aero 145
43	"Flight"	C. M. Lambert ...	Aero 45
44	Gp Capt E. L. Mole	Entrant	Aero 145
45	Vigors Aviation Ltd	The Marquess of Kildare	Apache
46	The Earl of Derby	D. B. Cartlidge ...	Piaggio P.166
47	Vigors Aviation Ltd	Wg Cdr T. A. Vigors...	Aztec
48	J. P. Tyszko	Entrant	Cessna 310c

D.H. Moth Minor (Gipsy Minor) G-AFPN, entrant and pilot D. R. Robertson; G-AFOZ, entrant P. G. Statt, pilot D. R. Stuart

Rollason Turbulent G-AJCP (Ardem 4CD2), entrant the Air League of the British Empire, pilot Air Cdre Paul; G-APZZ (Ardem 4CO2 F.H. Mod); entrant Rollason Aircraft, pilot N. H. Jones

Taylorcraft Plus D (Cirrus Minor 1) G-AHGZ, and pilot C. Gregory

Jodel D.117 (Continental C90-14F) G-APOZ, entrant Rollason Aircraft, pilot D. McDonell Hartas

Garland Linnet (Continental C90-14F) G-APNS, entrant HRH the Duke of Edinburgh, pilot Sqn Ldr J. Severne

Cessna 150 (Continental O-200-A) G-APZR, Airwork Services, pilot yet to be designated

BUSINESS AND

THE SHOREHAM TOURNAMENT . . .

aircraft up to 12,500lb gross weight. Both entrants and pilots must be British subjects.

The competition is in two parts, with a distance event over a circuit of some 380 miles today (May 20) and a series of aircraft tests at Shoreham tomorrow (May 21). The course for the former will begin and end at Shoreham, with turning points at Lympne, Sywell and Filton. Sywell is an optional refuelling stop for aircraft in Classes 1 and 2, while Class 3 machines must fly the course without any intermediate stop. In each aircraft all seats must be occupied—"by persons of 17 years or over, or weighing 130lb or more"—or ballast must be carried.

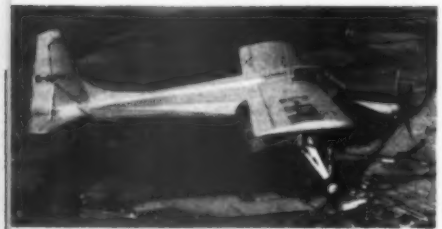
In the Friday distance event, aircraft will be started at two-minute intervals, beginning with those in Class 3 and followed by those in Classes 2 and 1 in that order. At the turning points, pilots must fly their aircraft (with the actual turning point on their port side) at such a height that the machine can be clearly identified by the turning-point observers. Any competitor not identified at a turning point may be disqualified from the contest. For those in Class 1 who land at Sywell for refuelling, a "dead time allowance" of 30min will be made (in special circumstances this period may be increased).

The Saturday tests will comprise five separate sections. The first is for short take-off, with competitors being required to clear a 10ft barrier "without sinking on to the ground again after passing over it." Short-landing performance will also be measured. In the third test the aircraft will be parked on a given position with doors and hoods closed, engine off, petrol off and aircraft chocked. On the start signal the pilot runs from the wingtip, enters the aircraft and starts the engine, and his time is noted from start to engine-running.

Following this engine-starting test, the aircraft must negotiate a marked taxiway leading to a parking bay where the machine must be stopped astride a marked centre-line. This test of manœuvrability is followed by a widely interpreted *Concours d'Elegance*, in which the aircraft will be judged on (1) comfort and convenience for pilot and passengers; (2) general condition and flight operating equipment fitted; and (3) luggage allowance per passenger. During all these tests the aircraft will be flown solo, and with full fuel tanks.

The system of marking for the distance event is based on the formula: Total points $=\frac{A \times Vb \times N}{10}$, where A = air miles per gallon;

Thruxton Jackaroo (Gipsy Major 1) G-APAM, and pilot Miss S. Scott



Prospector (Lycoming) G-APWX, the Earl of Bective; G-APWZ, K. Rutter

Piper Caribbean (Lycoming O-320) registration to be designated, entrant Vigors Aviation, pilot J. Youell

Piper TriPacer (Lycoming O-320-B) G-APXM, Vigors Aviation, pilot Flt Lt P. Austin

Proctor 5 (Gipsy Queen 2) G-AHGR, entrant and pilot H. W. Gray

Jodel D.140 (Lycoming O-360) G-AOVZ, entrant Rollason Aircraft, pilot C. P. Francis

Miles Monarch (Gipsy Major 1) G-AFJU, pilot D. Jackson

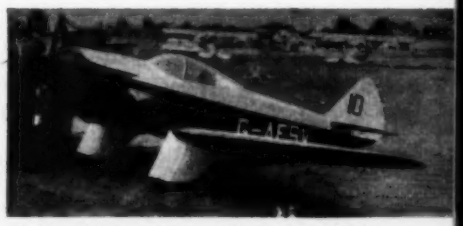
...inor (Walter Mikron 2) G-AFWT, entrant and ...D. Hodgson

D.H. Hornet Moth (Gipsy Major 1) G-ADNB, entrant Rollason Aircraft, pilot Miss M. McKellar

Piper Super Cub 150 (Lycoming O-320-A2B), entrant Vigors Aviation: G-ARAO, pilot B. Snook; G-APZJ, pilot Wg Cdr T. C. Murray

...ipmunk 22A (Gipsy Major 10 Mk 2) G-APOY, ...Airways Aero Association, pilot P. W. Brooks

Bristol-modified DHC1 Chipmunk 22A (Gipsy Major 10 Mk 2) G-AOTM, entrant and pilot P. G. Masefield



Chilton DW1a/1 (Walter Mikron 2) G-AFSV, entrant and pilot J. E. G. Appleyard

...S AND ...RCRAFT COMPETITION: CLASS 1 (above) CLASS 2 (below)

...m start
...gotiate a
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...nce, in
...enience
...perating
...During
...el tanks.
...on the
...gallon;

Vb=block speed; and *N*=number of seats ×(130+baggage weight in lb per seat)/150; or number of seats, whichever is the smaller. The maximum marks are here 1,500. On the second-day tests, points will be awarded as follows, again up to a maximum of 1,500:—

(A) Short take-off, 300 maximum marks. One mark deleted for every 2yd of take-off run used, measured from the barrier.

(B) Short landing, 300 maximum marks. One mark deleted for 2yd of landing run used, measured from base line.

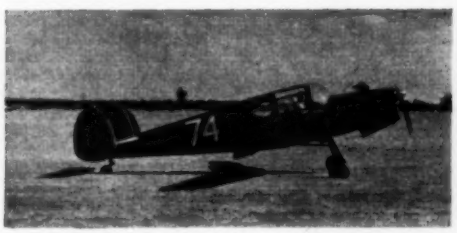
(C) Engine starting, 50 maximum marks. One mark deleted for each second of time taken for completion of this test.

(D) Manœuvrability, 150 maximum marks. One mark deleted for each second of time taken for completion of this test.

(E) Comfort and convenience, 200 maximum; general condition and flight operating equipment fitted, 300 maximum; baggage, 200 maximum (two marks for every pound per seat at 10lb/cu ft).

The winners in the three categories will receive respectively the John Percival Challenge Cup, the Kemsley Challenge Trophy and the Grosvenor Challenge Cup. The class winner with the highest number of total points will be declared the overall winner and will receive the Osram Cup. Cash prizes of £100, £75, £50 and £25 will go to the highest-placed entrants in each class. Two special prizes, of £50 and £25, will be awarded for the best performance in aircraft registered before January 1, 1950.

...G-APAM, ...G-AIKE (Lycoming O-290/3), entrant and ... Stewart-Wood; G-AGOH (Cirrus Minor 2), ...and pilot N. A. L. Thorne



Miles Messenger 4A (Gipsy Major 1D) G-ALAW, entrant and pilot P. B. Cash

MetaSokol L-40 (Walter M332) G-APWV, entrant and pilot J. Dougherty; G-APVU, entrant and pilot W. J. D. Roberts; third aircraft, entrant and pilot R. W. Kenny

...G-APXH, ...Courier (Lycoming GO-435-C2B2) G-APXH, ...Autair, pilot M. D. Parry

Cessna 175 (Continental GO-300-C) G-APYA, entrant Airwork Services, pilot R. H. McIntosh

Proctor 1 (Gipsy Queen 2) G-AIED, entrant and pilot J. C. C. Taylor

...FJU, ...Comanche 250 (Lycoming O-540) G-APZG, ...Vigors Aviation, pilot J. Fricker

Cessna 210 (Continental IO-470-E) N7303E, entrant Airwork Services, pilot G. Knox

Wassmer Super 4 (Lycoming O-360) F-BIXX, entrant and pilot H. Best-Devereux

Miles Gemini 3A (Gipsy Major 10/1) G-AKHC, entrant "Flight," pilot Maurice A. Smith

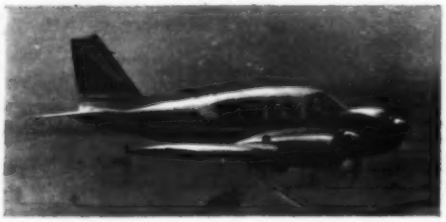
Super Aero 45 (Walter Minor 4-3) G-APRR, entrant "Flight," pilot C. M. Lambert; Super Aero 145 (Walter M.332) OK-NHF, entrant and pilot Gp Capt E. L. Mole; two others, entrant Dulmison Aircraft

Piaggio P.166 (Lycoming GSO-480-B1C6) G-AP[illegible] entrant the Earl of Derby, pilot D. B. Cartli[illegible]

BUSINESS AND TOURING AIRCRAFT COMPETITION: Class III

Piper Apache (Lycoming O-320-B) G-APFV, entrant Vigors Aviation, pilot the Marquess of Kildare

Piper Aztec (Lycoming O-320) G-APYX, entrant Vigors Aviation, pilot Wg Cdr T. A. Vigors



Cessna 310 (Continental), registration not designated, entrant and pilot J. P. Tyszko

THE SHOREHAM TOURNAMENT . . .

Who's Going to Win?

TANKS brimful of fuel, seats crowded with passengers, from early this morning 45 light aircraft will be setting out from Shoreham at the start of a two-day decider for the best business aircraft in Britain. Today, their tracks take them along the sea front and over the downs to Lympne, north-east over Gillingham and the mouth of the Thames to Sywell, over the Cotswold villages, westward-ho to Bristol, and past the plains and hills of Wiltshire back to Shoreham and the sea. Tomorrow the pilots will fly alone, in tests of skill and agility devised to examine each attribute of a business and touring aircraft.

It is a cunning competition, and much thought must have gone into the preparation of the rules and the allocation of marks. One of the 45 aircraft that sets out from Shoreham is going to be declared the winner; the pilot will receive the Osram Cup as outright champion and the aircraft the accolade as the best all-round business aircraft obtainable in Great Britain.

But which aircraft will it be? The result will depend upon preparation, upon training, upon the skill of the pilot, upon observance of the rules and—most of all—upon the aircraft itself. Many would say that the victor must be one of the highly professional American business aircraft that make up much of the entry, but such are the complexities of the formula and so much does this competition rely upon the best possible combination of man and machine that the result is by no means a foregone conclusion.

For example, there is nothing in the Royal Aero Club's rules which says that an aeroplane may not be modified. Its surface may be cleaned up, different seating fitted and any amount of radio equipment installed. Again, the weather could very directly affect the results, because if it is poor, aircraft best equipped with radio should be able to help themselves by using the rather scattered *en route* navigation aids. Besides, there are 300 marks to be awarded tomorrow for flight operating equipment fitted.

Seriously setting about winning has meant for most competitors finding out as much as possible about the aircraft in which they are entering. Clearly, some will pin their hopes on gaining high marks by virtue of good speed and low fuel consumption around the touring course on the first day. Others, with aircraft less economical but perhaps better equipped, will look to the second day's individual tests to recoup marks from the more lean and efficient ones. The outright winner could well be not the best performer in any of the individual events but simply the best all-rounder.

Undoubtedly the first day's cross-country test is the most important single event in the contest. It carries a maximum of 1,500 marks, to be won or lost over a distance of about 380 miles. The formula on which these marks are to be awarded is the product of air miles per gallon, block speed and number of seats. Likely winners will have made a careful study of what is involved in each of these factors. To all intents and purposes the part of the equation dealing with numbers of seats, that is, the factor N, is a constant. It is expressed (see page 687) as:—

$$N = \frac{\text{number of seats (130+lb baggage/seat)}}{150}$$

or number of seats, whichever is the smaller.

Now, the number of seats is the number given in the certificate of airworthiness for the aircraft. This has raised some problems since there are a number of types which are not capable of carrying both full fuel and a full complement of passengers and baggage. So a dispensation has been permitted by the Royal Aero Club, which allows a declaration to be made for weight-limited aircraft that the number of seats is that of the number of occupants who can actually be carried with full fuel.

This part of the formula is eminently sensible and useful; it means that the actual distance which has to be flown is not particularly significant; what will affect the results is that every aircraft which leaves Shoreham this morning must be absolutely full of fuel, and those which are weight limited will be penalized in the determination of the constant N in the formula.

Let's have a look at an example to see how this might work out for one hypothetical type. After allowance has been made for full fuel and the pilot one type might have, say, only 430lb left for passengers and baggage before it comes up to maximum take-off weight. Now, if we use very light passengers (as we are allowed to do by the rules provided they are over 17 years old) we can still declare our aeroplane as a four-seater. The total weight of the three passengers might be 410lb, which would leave us 20lb spare for baggage, or 5lb baggage per seat. If we put this into the formula we find that our N value comes to

$$N = \frac{4(130+5)}{150} = 3.6$$

So, as this is smaller than 4 the figure that we should get for N is 3.6. But supposing that our passengers weighed more than an average of 9st 5lb, could we do better by declaring the aircraft as a three-seater and filling up the baggage hold with baggage? The answer is no, because the highest number for N would then be the number of seats and in fact we should be a good deal worse off than we were before.

Having settled this matter of the constant we might now have another look at the remaining two variables in the formula, air miles per gallon and block speed. These are to be measured, say the rules, by dividing course distance by total fuel used, and course distance by the difference between landing and take-off time. So our problem is to fly as fast as we can while using as little fuel as possible. Before we try and sort our way through the infinite number of combinations of power, airspeed and height to find the one that will give us the best result we might just take

Determination of the optimum power setting to obtain the best combination of block speed and air miles per gallon. True air speed is used here as the speed parameter, and the formula value A×Vb is calculated at three different heights. Results are plotted on fig 4

(Vb) True air speed (m.p.h.)			Power (%)	Range (st. miles)			(A) a.m.p.g.			(A×Vb)/10		
2,000′	5,000′	8,000′		2,000′	5,000′	8,000′	2,000′	5,000′	8,000′	2,000′	5,000′	8,000′
133	137	141	50	855	875	890	17.4	17.8	18.1	232	244	255
140	145	148	55	850	870	885	17.4	17.7	18.0	244	257	266
151	156	160	65	820	835	845	16.7	17.0	17.2	252	266	26
156	161	—	70	785	800	—	16.0	16.3	—	250	262	—
161	165	—	75	745	755	—	15.2	15.4	—	245	254	—

another look at the course.

The first leg is only 60 miles and as most of the faster aircraft entered will cover this in under half an hour it is obviously not worth while to climb too high only to have to descend again to be identified at the first turning point at Lympne. But the next three legs are long ones, each of about 100 miles, and over a leg of this length some competitors may think it worth their while to climb to a more economical cruising altitude. Of course, the most suitable cruising height cannot be decided without taking into account the sort of climb and descent technique which is going to be followed. If the wind is strong it will have a considerable influence on the choice of cruising height and every competitor who has calculated a still-air technique will modify it for a tail wind or to reduce the effect of a headwind component.

The last few weekends have seen numbers of competitors practising around the course; there is, after all, only one real proof of the pudding. But as there are only a limited number of permutations that can be tried in any one flight it has also been worth while to take a look at theoretical performance.

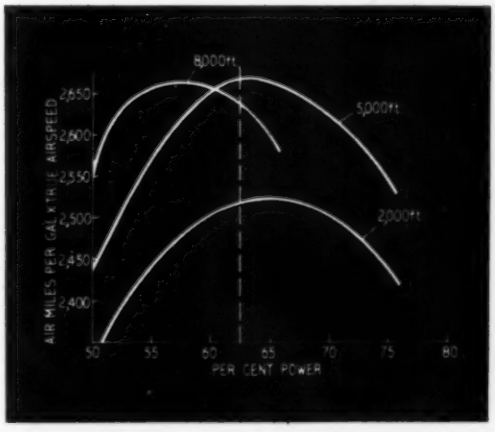
At the bottom of this page are shown a series of performance graphs with which it has been possible to calculate a power setting to get the best results on formula *at any one height*. (We hasten to add that these graphs do not apply to *Flight's* two entries or, indeed, to any other aircraft entered in the competition.) The aircraft under examination would fall into Class 2. It is a four-seater with a single engine and a variable-pitch propeller.

The first part of this theoretical determination of cruising technique is to select an arbitrary altitude. As shown on graph No 2 range—and hence fuel consumption—improves with height. And the lower the power setting the greater the improvement, although obviously to climb to 14,000ft at 50 per cent power would be quite impractical. It seems reasonable that on the longer legs 5,000ft might be a good compromise. From this assumption we can subsequently estimate a time-to-height and a time-to-descend, and determine for how much of the 380 miles we should be at our steady-state cruising speed. But we must start somewhere, so for a moment let's assume 5,000ft all the way round and pick off from graph No 1 the true airspeed that we shall achieve at 50, 55, 65, 70 and 75 per cent power. In curve No 2 we can follow the graph through to determine the range at each setting.

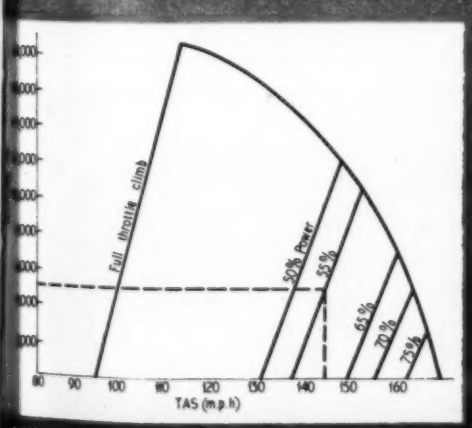
If we write each of these values down, it is easy enough to fill in columns 1, 2 and 3 in the table above, which also includes similar information for 8,000 and 2,000ft, the highest and lowest practical altitudes for this aeroplane over this course. The air miles per gallon figure in column 4 is quite simply achieved by reading off the theoretical still-air range from Figure 2. Since we know that we must start with full tanks we shall have on board something like 50gal of fuel. If we divide each maximum range by 50 this gives us the figure for air miles per gallon that we want to know. Of course, when flying the various legs there are a number of extraneous factors to be borne in mind. Air miles per gallon are not, in practice, going to be measured only while the aircraft are cruising at a steady height. It is important to conserve fuel from the moment that engines are started until taxying up to the petrol pumps and switching off after landing. Warm-up time is likely to be rather an embarrassment and most competitors may try to run their engines and circulate their oil before they finally fuel up their tanks. Naturally, after crossing the finishing line everyone will want to conserve their remaining fuel and get down as soon as possible. But a mêlée has been anticipated by the rules, and after crossing the finishing line competitors may not make any abrupt changes in flight path but must climb gradually to a thousand feet before joining the circuit in the normal way.

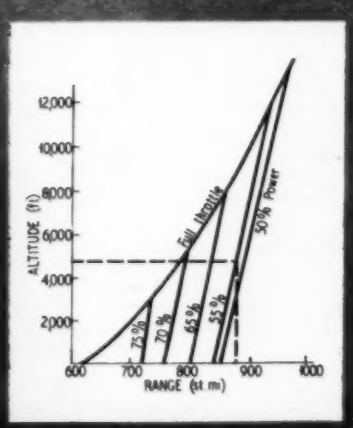
So much for fuel consumption. If we look back at the table again a number of points are apparent. The first is that for the 10 per cent increase in power between 50 and 55 per cent there is a gain in speed of 8 m.p.h., or 5.8 per cent. Between 65 and 70 per cent power this gain has been reduced to 3.2 per cent and over the next increment of power increase the gain is less than 2½ per cent. There is a similar diminishing return with the range equation, the range falling off very sharply as power is increased. These two factors are reflected in the column showing air miles per gallon; efficiency falls off sharply at high powers. Nevertheless since the formula takes account of block speed it is not the lowest power setting and the greatest number of air miles per gallon that are going to win this competition; we have got to find just the right combination of power and height to produce the highest value of the product of *A* (air miles per gallon) and *Vb* (block speed).

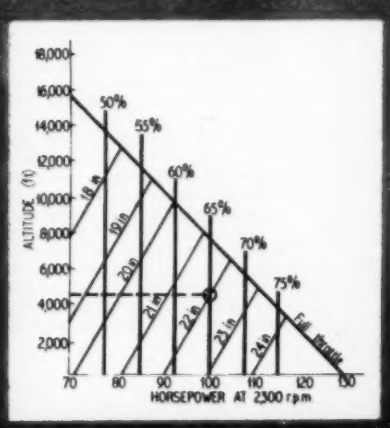
Block speed depends not only upon cruising speed but also upon a number of imponderab'es such as take-off distance and wind, and the air miles per gallon figure will be affected by ground-running, time to turn on to course and climb. Since it is impossible to make any realistic estimate of the conditions at Shoreham on race day, for our theoretical analysis we can multiply true airspeed by air miles per gallon, i.e., find the product of column 1



These curves—explained in the text—show one way in which optimum performance in the touring part of the event might be estimated. The graphs do not apply to any aircraft entered in the competition. Below, left to right, figs 1, 2 and 3 and right, fig 4







Potentially a heavy scorer in the concours d'elegance is the splendidly equipped and comfortable Cessna 310. Note the generous door width

THE SHOREHAM TOURNAMENT . . .

and column 4 at various altitudes. This is plotted on graph No 4 and its conclusions are extremely interesting. They show that for the aeroplane under consideration the best figure that could be achieved is 266. This maximum occurs at a height of 8,000ft at 55 per cent power or at 5,000ft at 65 per cent power, and since, in practice, time spent in climbing can only be time wasted this particular aeroplane is obviously best flown at our first-guess height of 5,000ft. On the other hand, the lowest altitude examined is shown to be uneconomic, although 3,000ft and 65 per cent power might be the best combination for the first short leg of 60 miles. Again, additional fuel and time spent climbing must be offset against the better performance achieved at the ideal cruising height.

Finally from graph No 3 can be obtained the information that we want to know in order to operate the aeroplane—the actual throttle and r.p.m. settings to use. This particular curve is drawn for 2,350 r.p.m., with carburettor air at cold and mixture set for best power. From the graph we can see that, cruising at 5,000ft at 65 per cent power, we ought to set up 22in boost. It is possible to go and do other sums to decide the best climb and descent technique, but on reflection this seems a refinement hardly worth considering; in practice the aeroplane we have been looking at here might be climbed at 70 to 75 per cent power and at an airspeed adjusted according to the strength of the head- or tail-wind.

If the aeroplane we were studying had a fixed-pitch propeller, then the best technique might be to avoid undue slip angles by flying it at as near as possible to the optimum speed for the propeller. This would mean a rather fast climb and throttling fairly well back in the descent so that speed would not become excessive. But we should not reduce speed too far or drag from disc effect would make itself felt.

What of other preparation for tomorrow's events? Those most obviously requiring practice are the short take-offs and landings which comprise tests A and B. The former is the more demanding in judgment because conditions at Shoreham tomorrow cannot be predicted. Best performer here is likely to be one of the aircraft in Class 1 and the Piper Super Cub looks a very hot favourite. In Class 2 the Helio Courier may well set the pace. It certainly should do so on sheer take-off and landing performance but such a high degree of pilot skill is involved that the field is very open. Competition may also be very close in Class 3 and the Piper-Cessna battle should be right royal.

Is there anything that can be done to determine beforehand take-off distance over a 10ft barrier? Those who have been practising should find their efforts worth while if conditions have been representative. Those whose flight manual includes a take-off performance graph should be able to apply their test results to it and extrapolate the take-off distance that has to be declared at Shoreham. In any case, tomorrow we ought to see some highly developed take-off techniques, with throttles well bent before brakes are released. One or two aircraft—the TriPacer might be among them—may also try the fancy technique of lowering flap during the take-off. The twins have special problems of their own, any tendency to swing becoming marked on a full throttle take-off. Competitors who are really serious about their aircraft's performance will have also checked the rigging of the airframe and made sure beforehand that carburettors and fuel injectors are correctly adjusted.

Two other events which form part of Saturday's contest have more of a motoring flavour than an aeronautical one. These are engine-starting and manœuvrability. For the starting test the pilot has to stand at the wing tip and, on the word "go," leap on to the step, open the cockpit, jump in, switch on fuel and magnetos and start the engines as quickly as possible. The best time for doing this may be as little as ten or eleven seconds if a start can be made with engines hot. No special condition stated in the regulations, so it seems fair to assume that there is no objection to aircraft coming up to the line with engines really warm. Here again the twins, with two engines to start, are at a disadvantage (who will try operating both starters together?) although they may gain a little by having cockpits that are larger and easier to clamber into. In theory this test should also favour high wings and in Class 1 could profit the Super Cub, Cessna and Taylorcraft against the other entrants. Nevertheless not all high-wing aeroplanes are easy of access and to some extent this is more a test of the sprightliness of the pilot than the starting performance of the aircraft. There are one or two dodges here that could be used to make starting more certain; there is nothing in the rules, for example, which says that throttles may not be cracked open the right amount before the pilot makes his run, and there is nothing like practice for making sure which are the right switches when they have to be found in a hurry.

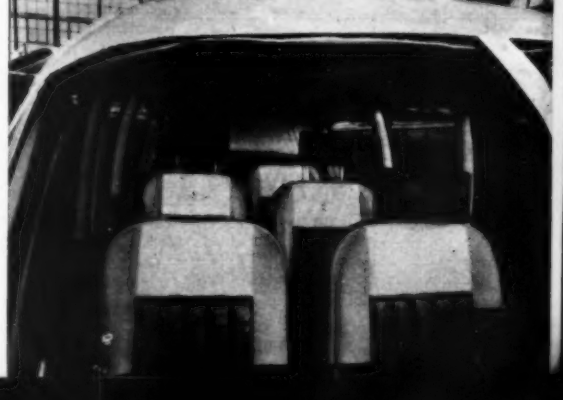
The ground manœuvrability test, it seems, is a check of good brakes, a v.p. propeller and good engine acceleration. There is a handsome bonus for tricycle undercarriages. The pylons are spaced sufficiently far apart to make this a pretty high speed trial and an intrepid conductor might cover the course in 35sec. As the diagram (p. 685) shows, after leaving the line aircraft are taken through the wiggle-woggle, brake hard at the last pylon, turn left 90°, accelerate 200ft, brake hard again and turn left through nearly 180° round an awkwardly placed marker in the centre, and then wind into a parking box, braking to a stop with the main undercarriage astride a centre-line. This is a test that demands the very utmost determination from pilots manœuvring in an unnatural environment, but it is worth doing well as it carries 150 marks.

By contrast the final test—the concours d'elegance, comfort and equipment—carries no fewer than 700 marks, nearly half the total for the day and a quarter of the total marks. Here there is very little that entrants can do to put their house in order, although it seems permissible to load the aircraft up with the maximum amount of radio that it will carry. A point about the interpretation of the rules here is that on the second day baggage allowance will not be calculated on a weight basis but by space. Surveyors will visit each aircraft to measure the baggage compartment and thus assess its carrying capacity. The maximum number of marks for baggage is 200, awarded as 2 for every pound per seat at 10lb per cu ft. So to obtain maximum marks an aircraft would have to have 100lb of baggage space (i.e., 10 cu ft) per seat—hence a rather unlikely 40 cu ft capacity for a four-seater. When baggage capacity has been tested there are still 500 marks to be awarded for comfort and convenience, general condition and flight operating equipment fitted. The value of radio aids—VHF, VOR, ADFs and so on has already been referred to, while the other headings are intangibles and marks must depend upon the opinions of judges Ian Forbes (chief test pilot of Miles Aircraft) and Air Cdre A. H. Wheeler. Certainly the marks awarded for general condition should ensure a sparkling turn-out this weekend. But if there are still ties to be decided when the concours is judged it seems hard to believe that the luxurious interiors of the new Cessnas and Pipers will not carry great weight with the judges.

Who is going to win at Shoreham? How will the Aztec compare with the Cessna 310, and the Cessna 210 with the Comanche, and the 150 with the Super Cub? Is a Meta-Sokol a match—on this type of marking—for a Jodel 140? Just how fast and efficient are all the modifications which have been made to the "Bristol" Chipmunk? We are too canny to try to guess, but today and tomorrow there may be some surprises in store. In any case this competition cannot help but stimulate British business flying; in that endeavour its purpose was achieved even before this morning's flying began.

ALASTAIR PUGH

Ranged against the Cessna 310 will be the Piper Aztec. With full tanks all these seats can be filled and there is a generous allowance for baggage. Both aircraft have adjustable headrests



"Flight" photograph

Port engine feathered and gear being pumped up by hand, the Piper Aztec's remarkable take-off safety is demonstrated by Tim Vigors

Fresh from the States

THREE significant and interesting American aircraft have just become available for air testing in Britain. In these pages Mark Lambert describes the Piper Aztec and Beech Travel Air and Alastair Pugh the fast new Bellanca 260.

PIPER AZTEC

WE had been badgering Vigors Aviation Ltd, the British Piper distributors, for a flight in the Aztec because we considered it one of the most important new twins. I was accordingly let loose on the first Aztec to reach Britain, immediately after it had been cleared by the ARB following transatlantic delivery. It is certainly an impressive machine and up to the best American "second generation" standards, with remarkable performance, weight-carrying ability and especially good and pleasant handling characteristics. Ailerons are light and give a high rate of roll at all speeds. The slab tail with anti-balance tab seems to be uniformly effective and light throughout the speed range and directional stability and control harmonization are particularly good. This is something like a pilot's aeroplane.

The two Lycoming O-540 250 h.p. engines are smooth and powerful and the cabin is large and roomy with all the customary American luxury features. Most important, this aircraft can do a real job, as its weight schedule shows. Gross weight is 4,800lb and basic weight, including the £6,000 standard radio package (ADF, three VHF receivers with two VOR adapters, two VHF transmitters and marker beacon receiver), is 2,906lb. Full tankage of 120 Imp gal and oil weigh 909lb, leaving 985lb for pilot and four passengers at 170lb each and 135lb of baggage. That means full

By MARK LAMBERT **No 123 of the "In the Air" Series**

tankage can be used with full passengers, radio and plenty of baggage. At this load, range is 1,200 miles at 65 per cent power and 1,025 miles at 75 per cent power. At 2,000ft, 75 per cent power gave us an i.a.s. of 180 m.p.h.

I first saw the Aztec just beginning a take-off at Kidlington. Immediately after unsticking, Tim Vigors, the pilot, feathered one engine 10ft off the ground and climbed away at a quite normal angle. He told me later that he feathered the port engine in order to let spectators see the manœuvre clearly and therefore had to raise the undercarriage by hand pump during the climb-away. Such performance adds up to almost unique safety. Minimum single-engined control speed is less than 10 m.p.h. above the clean stalling speed. Incidentally, the US Navy has ordered a number of Aztecs "off the shelf" as command transports—and the US Navy rates the safety of admirals very high.

The Aztec is based on the Apache to the extent that both aircraft have virtually the same wing, but the Aztec ailerons have been re-worked to provide increased response. The engine cowlings make the big 250 h.p. Lycomings into quite fat "power eggs"; and the tricycle undercarriage, whose main legs retract forwards, has three dumpy, low-pressure tyres. The flaps are of the split type.

Cabin accommodation is fully up to American standards, and in the aircraft I flew all the seats were provided with adjustable head-rests and reclining back-rests. The pilots' seats slide forward and backwards, if required, with positive and simple release catches. The three rearward seats are mounted on rails so that they can slide over the full length of the cabin to allow easy access and a wide variety of positions. One can, for instance, recline one of the centre seats and position the other as a comfortable leg rest, or move all the seats right forward to clear the rear of the cabin for bulky baggage. Main access is by foot-step and hand-hold over the gently sloping wingskin to the single, car-type door on the starboard side. A separate, large baggage hatch gives waist-high access to the rear of the cabin from the starboard side. On the ground, the wing tips are just above waist level, giving easy access to the four fuel-filler caps.

The tail control-surfaces at once give an indication of special handling characteristics: the very large, slightly swept fin and a big rudder equipped with a correspondingly large trim tab promise good directional and single-engined handling. Even more striking are the single-piece slab tailplane and trimmable anti-balance tab, which have already proved their worth on the Comanche.

Control and instrument layout in the forward end of the cabin leave little to be desired. Full blind-flying instruments are to port, with a two-way tumbler switch on the extreme left controlling engine starting. Immediately beneath, really sensibly placed, is the parking brake catch. Beneath the instruments is a row of switches for magnetos, fuel booster pumps and various other services. In the centre is a shallow console for throttle, pitch and mixture levers, differentiated by the bright colouring of their plastic knobs. Immediately below are flap and undercarriage levers, appropriately shaped, with the undercarriage condition lights between them. The flap position dial is just to the right of the radios, which occupy the centre portion of the main panel, just beneath the dual manifold pressure gauge and individual r.p.m. indicators. A small lid opens underneath the port side of the main panel to reveal a row of circuit breakers, and a large drawer pulls out from the equivalent position on the starboard side. There is also a glove compartment and room for a few additional dials or radio on the far right side.

Standard dual control is fitted, with push-pull wheels emerging from the panel; individual brake toe-pedals are on the port side only. Far down and well forward beneath the throttle quadrant are the master switch, deliberately tucked away, and cabin heating and ventilating controls. Between the front seats is a separate panel incorporating engine primer pumps, fuel tank selector switches and a switch controlling pressure cross-feed. Immediately aft of these are the fire extinguisher controls. The tank selector switches have spring-loaded gates to prevent inadvertent movement and the two contents gauges are arranged to show the contents of whichever tanks are selected.

Both flap and undercarriage are hydraulically actuated and a hand-pump lever can be extended from beneath the throttle quadrant for manual operation in case the single hydraulic pump on the port engine goes out of action. In the event of loss of

Fresh from the States . . .

Even with five people on board and the starboard engine feathered it was easy to formate on the Super Cub used by the "Flight" photographer

hydraulic fluid the undercarriage can be lowered by stored compressed air fed to the jacks through separate pipes and released by a trigger located beneath a removable floor panel under the pilot's seat. Rudder and tailplane trim are controlled from concentrically mounted winding handles located in the cabin ceiling and having individual indicators nearby.

I flew first in the co-pilot's seat with Tim Vigors while we made a short flight to get the feel of things. The noise and vibration level were very low, normal conversation being audible and radio calls coming clearly from a loudspeaker just above the 1st pilot's left ear. With the clear-vision panel open we had plenty of fresh air on the ground, despite the heat of the day.

Visibility forwards and sideways was ample for taxying and flying and the rearmost side windows afforded a better-than-usual rearward view, although directly rearwards and upwards one was blind. The windows are high enough to afford adequate clearing visibility for turns, but I found that the sunblinds above the windscreen obscured some of the window area and could not be folded back out of the way without fouling the trim handles.

Control on the ground was excellent, the large tyres and good suspension giving a smooth, comfortable ride on roughish grass. The nosewheel, which is spring-linked to the rudder pedals, allowed quite sharp turns and precise control for taxying, landing and take-off. Turns could be tightened by use of brake so that we turned through 180° in two-thirds the width of a 30ft-wide taxiway—with the inboard wing-tip moving backwards over the ground. Asymmetric power was unnecessary for this performance.

Pre-take-off vital actions were straightforward and printed on a card. Full power could be held on the brakes and initial acceleration was smooth and powerful without any detectable swing. The nosewheel can be held down to 80 m.p.h. without any rough riding on undulating grass, but the Aztec wants to fly itself off at a little over 70 m.p.h. Tim Vigors held it down to 80 m.p.h., lifted off and immediately feathered one engine by yanking the mixture and pitch levers hard back with one hand. The pitch lever goes into the feather position against a friction crutch and not through a gate. The propeller stopped almost immediately and there was a barely detectable instantaneous swing before we settled into the climb at 110 m.p.h. This was obviously no sweat at all.

I then flew the Aztec around for a while and was told to cut the port engine at 150 m.p.h. with my feet off the rudders. When I did so the aircraft twitched slightly to the left, but I needed only to apply about 20° starboard aileron-wheel movement to hold the cut engine and could do so without any need to trim. Restarting required normal pitch, rich mixture and closed throttle and some use of the starter to unfeather and get windmilling. Then mixture was placed to idle cut-off, throttle cracked and mixture put into rich again as soon as r.p.m. reached 1,000. After that the engine could be opened up again for immediate normal use. The aircraft was so easy to control during these operations that full attention could be given to reading the re-starting check-list.

We then came back for a landing. Extension of flap caused a certain nose-up trim change, but the trimmer was effective and exact, though low-geared. We approached at 80 m.p.h. with a trickle of power and landed without any difficulty. Control remained precise and light and hard brake could be applied immediately after touching-down.

"Flight" photograph

After this preliminary run-round Tim Vigors got out, I took the 1st pilot's seat, colleague Alastair Pugh took the right seat and two passengers remained in the back. We had flown for about 30min since the tanks had been completely filled, and we were therefore at fairly near full load. With 15 minutes' dual I felt completely confident about flying solo.

Now that we were alone we settled down to take some notes and measurements. On take-off we again noticed good undercarriage damping and excellent nosewheel behaviour on undulating grass. The Aztec's big tyres and large nosewheel are great assets on such a surface. The aircraft flew itself off at about 75 m.p.h. and, climbing at 110 m.p.h., we measured 1,300ft/min climb between 1,800ft and 2,500ft, not flying quite accurately—it can do 1,600ft/min. At 3,000ft we set 2,400 r.p.m. and 23in intake pressure, 75 per cent power, and the speed built up rapidly from 110 m.p.h. to about 140 m.p.h. Thereafter it increased slowly to 185 m.p.h., with a gradual nose-up trim-change caused by positive stability. Trim-changes with speed, though clearly noticeable on the wheel, were not as intrusive as they are with some aircraft. This gentle indication without brute force is a feature which makes the Aztec a pilot's aircraft rather than an operator's, and we liked it.

Next pleasant experience was a very high rate of roll with light, though not absolutely crisp, ailerons. We were pressed for time and did not wait to try stability or rate of roll, but the Aztec was exceptionally manœuvrable and pleasant to fly and maintained this full control right down to the lowest speeds. It could also be trimmed hands-off in all normal flight conditions. Rapid turns and reversals of turns required if anything opposite rudder—a function of the big fin—and it was hardly worth trying to co-ordinate them.

I next slowed down and held the gradually mounting stick forces; the stall-warning light shone at 80 m.p.h. Maintaining level flight, I noticed a considerable increase in angle of attack as the speed finally fell off to 70 m.p.h., when a sharp judder announced the stall. The Aztec fell away in a nose-up attitude and tended to drop one wing slowly. Release of stick pressure ensured recovery. Good aileron control remained right up to the stall. The undercarriage may be extended at up to 150 m.p.h., and we found that it caused no trim change. The first part of flap produced no trim change either, but full flap brought a decided nose-up tendency which was relieved with half forward-trim travel. We then stalled at between 60 and 65 m.p.h. with a pronounced judder just short of the stall but retaining aileron control till the last second. The nose again stayed up and recovery was immediate. With less than full power we then found we could climb at an indicated 52 m.p.h. and full aileron control—this with four occupants and almost full fuel. Power had a very marked effect on stalling speed.

All controls remained light and the tailplane was particularly pleasant and precise even at these low speeds. With power off I then pulled sharply back on the stick at just below 70 m.p.h., noticing a good g margin and ample tailplane control. Pulling quickly back at a lower speed, an accelerated stall came with

The Aztec's "office" is neat and roomy, with all mod. con. including autopilot. The darker radio panel in the centre contains airline-standard ADF, three VHF receivers with two VOR adapters, two VHF transmitters and marker beacon receiver. Costing £6,000, this is a standard Piper radio package. Note the deep upholstery and large door

almost violent juddering. There was therefore plenty of control and reserve lift for rounding-out after a slow approach. There was no noticeable sink short of the stall. All this promised very pleasant approach and landing characteristics.

We next flew clean at 150 m.p.h. and again cut the port engine suddenly with the rudder free. Again we held it comfortably on aileron alone. Single-engined flying could hardly be more docile and stable. We set up a full-power climb at 110 m.p.h. at about 500ft and suddenly cut the port engine. The propeller stopped, feathered, in 5sec and again there was that remarkably slight swing and light control. We trimmed out the dead engine completely and flew hands-off at 110 m.p.h. noting a single-engined climb which exactly tallied with brochure figures. We then pulled the speed back to the minimum control value of 80 m.p.h. There was a firm residual rudder load because we could obtain only half rudder trim travel, but normally the Aztec can be trimmed hands-off at minimum control speed with one engine at full power. Little aileron is needed. Below 80 m.p.h. the aircraft simply yawed gently to port and we were able to fly happily for some time at 75 m.p.h. We restarted at below 100 m.p.h. without any difficulty. The rudder trimmer is high-geared and powerful in its central range so that initial forces can be very rapidly trimmed out. Retrimming for two engines calls for small control movements.

This much wringing out of a heavily loaded Aztec gave me very great confidence in the aircraft. It felt safe, simple and really responsive. For the first landing approach I selected 80 m.p.h. with full flap and noted a rate of descent of about 1,000ft/min —not excessive and giving a fairly shallow descent gradient. The round-out was light and precise with power on or off. In the latter case the float was short. Touch-down was absolutely straightforward and the Aztec rolled smoothly over the grass, albeit with some undercarriage noise. It could be stopped quickly and turned off at fairly high speed.

I cannot think of any complaints about the Aztec. It is simple to fly, but also exhilarating and has impressive single-engined capability. I think that instrument panel-space might be limited unless the miniaturized types of radio equipment were fitted, but the standard Piper radio package provides more capacity than the average traveller is ever likely to require. In my opinion, the horizontal tail control is near-perfect and does not heavy up at high speeds. Directional stability is perhaps on the strong side, but this pays dividends in single-engined handling which no-one could ignore. The ailerons are impressive and the general feel of the aircraft is exceptionally good. My compliments, too, to that undercarriage. This should not be considered as an overgrown Apache, but as an entirely new aircraft.

BEECH TRAVEL AIR

No. 124 of the "In the Air" Series

Beech Travel Air G-APUB being handed over last year at Wichita before Beverly Snook, left, ferried it to Britain via the Azores. Below, the 1960 model with increased dorsal fin and other improvements

FOR the last ten months, Woods of Colchester have been operating a Beech Travel Air from Biggin Hill, flying some 500hr in frequent trips to Africa or the continent. Registered G-APUB, the aircraft is fitted with Narco Mk 5 VHF, Narco Omnigator, Lear ADF 12E and Sun Air HF radios as well as additional soundproofing for the rear of the cabin and a combustion heater and air conditioning equipment. It is powered by two Lycoming O-360 180 h.p. engines with two-blade constant-speed propellers. Standard tankage in the wing roots is 21 Imp gal each side and G-APUB has the two optional additional tanks of 26 Imp gal outboard of the engines. Empty and gross weights are respectively 2,570lb and 4,000lb and this machine can carry full fuel, four occupants and 25lb of baggage. Wing loading is 20.6lb/sq ft and power loading a very low 11.1lb/h.p. With standard tankage, 917lb are available for people, baggage and equipment; and two compartments in the nose and at the rear of the cabin can accommodate 270lb loads each. At gross weight, twin- and single-engined climbs are respectively 1,360ft/min and 225ft/min and ceilings respectively 19,300ft and 6,500ft. Range at 165 m.p.h. is 1,410 miles and endurance is quoted, perhaps a little optimistically, as 8.75hr.

When G-APUB was recently in England for a 50hr check I flew it with Mr Woodhouse, the company's pilot, and was most impressed with its handling. It has sweet, crisp controls, excellently harmonized, and very good single-engined behaviour; and it steams along very happily at over 180 m.p.h. It looks like a Twin Bonanza in photographs, but it is really as small as an Apache and sleek. It is in fact a direct adaptation of the single-engined Bonanza, having the same cabin and rear fuselage with a conventional tail and Bonanza wings with squared-off, washed-out tip extensions. This makes it a snug four-seater with a bench rear seat having individual back-rests which can be reclined into the baggage space immediately behind. There is a separate baggage hatch and a car-type door, footstep and handle provide the passenger access, all from the starboard side. Visibility upwards, sideways and rearwards is exceptionally good because of the deep curved windows, but a high coaming and the wide nose, together with flat-topped engine nacelles, detract somewhat from map-reading and taxying visibility forwards and downwards. Both front seats slide forwards and have tipping and reclining back-rests; and the rudder pedals are also adjustable. Those on the right side can be folded flat into the floor. The single control wheel offset from the centre can be set high or low and swung over for the co-pilot's use. Toe-brake pedals are fitted to port only. There is adequate ventilation and the centre side windows can be tilted open on the ground or jettisoned for emergency escape. All seats have a harness which can be used for lap only or shoulders as well.

Instruments are conventionally laid out on the main panel, with throttle, pitch and mixture levers immediately above the control-wheel pivot. Flaps and undercarriage are both electrically operated from shaped levers near the centre of the panel. Full engine (and carburettor temperature) gauges are fitted and small electrically operated cooling gills beneath the engine cowlings may be opened during prolonged ground-running or in tropical conditions. Otherwise they are simply left shut. Switches are scattered on the lower level of the panel and magneto switches and starter buttons are grouped on the port wall. Fuel selectors and cross-feed system are in front of the seats, between the pilots. The undercarriage may be mechanically lowered by a hand crank down behind the pilot's seat. The pilot's space is slightly restricted, but there is enough adjustment to make it comfortable. Visibility would be improved if the seat were an inch higher.

The general finish of the aircraft was very good, with careful streamlining and obviously stout structure. The very thin, fixed tailplane carried a large elevator, spring-loaded downwards to give strong positive stability and to keep the control wheel forward on the ground. There were two large elevator trim tabs and a large rudder tab. The ailerons had almost sealed, plain forward edges and small geared tabs and were set well in from the wing-tips. The flaps travelled outwards and downwards when extending. They moved slowly and their extension was shown by marked lines on the upper skin, visible from the pilot's seat. Engine starting was easy and the noise level remarkably low. The hydraulic, single-disc brakes were light and very effective and the nosewheel was springily coupled to the rudder pedals, giving a sufficiently sharp unassisted radius to turn round on a runway. With a touch of brake and a little engine I turned in two-thirds of

Fresh from the States . . .

a 30ft-wide taxiway. On tarmac we rolled smoothly but the small nosewheel seemed to make slightly heavy going on very rough grass. Suspension generally gave a very stable ride.

With myself flying and Mr Woodhouse on the right, the c.g., I was told, was a long way forward. I made the first take-off clean and noticed a mild swing to port before the rudder became effective. It could be held easily with nosewheel steering but, with practice, could be completely cancelled out instinctively with a touch of asymmetric throttle. Airflow soon centralized the spring-loaded elevators and I flew off at 80 m.p.h. The gear came up in three or four seconds with a curious subdued howling noise and we very quickly gained the 110 m.p.h. climbing speed. The nose had to be progressively pulled up until we were soaring upwards at a good 1,300ft/min. Immediately apparent were particularly smooth and responsive ailerons—a fraction heavier but just as nice as those of a Gemini. Elevator was equally smooth, but a fraction heavier again. The Travel Air has a rare classic feel.

At 2,800ft I levelled off and set 23in and 2,250 r.p.m. The speed built up steadily to no less than 183 m.p.h. with a steady nose-up trim change showing decisive positive stability. The controls remained precise and very smooth. Elevator trim was high-geared and powerful—a surprise to the unwary—but there was no backlash and exact settings were possible at any speed. With rudder alone I found I could make precisely co-ordinated turns and lateral stability was exactly neutral. Turns could normally be made with aileron alone with only the slightest slip, and attempts to co-ordinate with rudder tended to aggravate rather than eliminate what there was. Less good was directional stability. Bumps caused slight, short-period snaking. Longitudinally, a small nose-up displacement was followed by only one very slow phugoid. At 180 m.p.h. I tried the rate of roll and estimated a sprightly 20deg/sec with far from full aileron. We were going too fast to be brutal with the controls. Steep turns were very pleasant. The overall impression of handling at cruising speed was excellent.

Stall Characteristics

At 3,700ft and 140 m.p.h. I closed the throttles and the speed fell slowly off with steadily mounting nose-down forces—heavier than those in an Aztec in the same manœuvre. At 85 m.p.h. the stall-warning hooter sounded and I still had good though less precise aileron control. A liberal judder then announced the stall at 70 m.p.h. and one wing dropped gently. I released back pressure to let the nose down and then began to level off again. Immediately we stalled again—when many other aircraft would have recovered completely. I also noticed that rapid use of full aileron just above stalling speed caused an incipient stall. First, I think the elevator is much more powerful than one expects (more of this later) and secondly, the long ailerons are set well inboard of the wing-tip so that they have a greater effect on breakaway of airflow than if they were nearer the washed-out tip.

Flying hands-off at 125 m.p.h. I selected wheels down. They locked in about three seconds with that curious screech and caused absolutely no trim change. They may be lowered at up to 150 m.p.h. Selecting flap, produced 20° in seven seconds without trim change. With the full 32° there was a strong nose-down tendency which I could just trim out with power off at 100 m.p.h.—our c.g. was a long way forward.

Recommended approach speed is 100 m.p.h., equal to the best single-engined climbing speed, but 90 m.p.h. or even lower would be quite comfortable and the Travel Air is admirably stable in this condition. There is little trimming to do and the aircraft flies itself while downwind vital actions and checks are completed.

The stall with 15° of flap came at 70 m.p.h., the same as the clean stall, and with the same gentle sink and tendency to lower the right wing. Waggling of the ailerons also again tended to increase the stalling speed and a proper recovery was required if a second stall was to be avoided. Aileron control remained up to the stall. The stalling speed does not vary with configuration, but the stall warner sounds rather later when flap is down.

I now went to 3,500ft and settled into a full-power climb at 110 m.p.h. I then cut the port engine by closing the throttle and pulling the pitch lever into its friction crutch for feathering. The propeller windmilled for a while but had stopped dead, feathered, after 7 sec. Yaw was very slight and very little effort was needed to hold the asymmetric power. At about 105 m.p.h. we climbed at 300ft/min and soon gained 450ft. Large aileron deflections noticeably decreased single-engined climb. Like elevator trim, rudder trim was very high-geared and the full range would hold one engine on full power at about 110 m.p.h. With reasonable residual rudder forces, I slowed down to the minimum control speed of 84 m.p.h., needing very little aileron and apparently less than full rudder. There was no tendency to yaw away and no sign of a stall. Restarting was straightforward, using the starter motor to spin and so unfeather the propeller.

Landing Technique

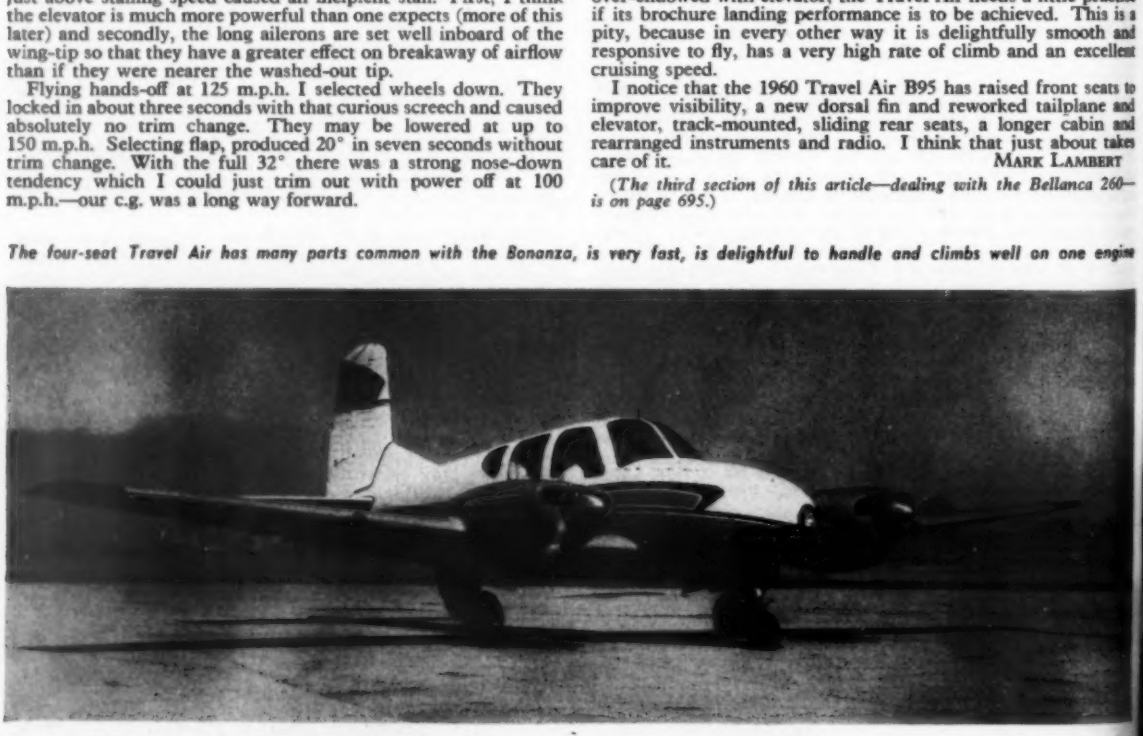
I rejoined the circuit and, approaching first at 100 m.p.h., I noticed a fairly shallow descent gradient (1,000ft/min) with full flap and power off. I reduced the speed to 90 m.p.h. with a little power and throttled back very slowly as I rounded out. The elevator was if anything over-powerful and I tended to over-control. After a smooth touch-down following some float I pulled back to keep the nosewheel up. Then, feeling the landing to be accomplished, I pulled hard back to keep the nose up as long as possible and the Travel Air pitched hard up. There was more than enough elevator, particularly considering the forward c.g. position. A second circuit went more smoothly, using Mr Woodhouse's suggested technique of approaching at 100 m.p.h. and cutting power at the very beginning of the round-out. This shortened the float and there was still lots of elevator. I feel that the Travel Air could be approached safely at about 85 m.p.h. with due caution during the round-out. Only with such a technique could one achieve the brochure landing distance of about 300yd. We used more like 500yd of tarmac in a light wind and without very much braking. Because it is perhaps a little short of flap and a fraction over-endowed with elevator, the Travel Air needs a little practice if its brochure landing performance is to be achieved. This is a pity, because in every other way it is delightfully smooth and responsive to fly, has a very high rate of climb and an excellent cruising speed.

I notice that the 1960 Travel Air B95 has raised front seats to improve visibility, a new dorsal fin and reworked tailplane and elevator, track-mounted, sliding rear seats, a longer cabin and rearranged instruments and radio. I think that just about takes care of it.

MARK LAMBERT

(The third section of this article—dealing with the Bellanca 260—is on page 695.)

The four-seat Travel Air has many parts common with the Bonanza, is very fast, is delightful to handle and climbs well on one engine



Fresh from the States . . .

BELLANCA 260

No 125 of the "In the Air" Series **By ALASTAIR PUGH**

UNDOUBTEDLY one of the more entertaining US newcomers to be introduced into Europe recently (British representatives are Peter Clifford & Co, Oxford Airport) is the Bellanca 260. Among contemporaries which have reached a fair degree of conformity the design is individualistic to the point of eccentricity. The majority of the airframe is finished by means of a skilful technique of Fiberglas coating which confers upon it a surface of outstanding smoothness; in anachronistic contrast, the tailplane and rudder are wire-braced in a manner that was not unfamiliar in the 'twenties and 'thirties.

For all its 260 h.p. fuel-injection engine, the Bellanca is a faster aeroplane than might be expected, and to my mind this can be attributed to the real joy of a wing. Construction is conventional, with a laminated spruce spar, spruce ribs and mahogany-ply skin, but after assembly the whole unit is dipped in a bath to emerge sealed in synthetic resin. It is subsequently sheathed in Fiberglas, also used as a coating for the metal-tube fuselage.

The 1960 Bellanca 260 is a development of the Cruisemaster, which it now supersedes. The main change is the installation of the Continental IO-470-F fuel-injection 260 h.p. engine, a generous power unit for the gross weight of 2,700lb, but one which can offer a useful balance of performance and economy.

Also new are the rather short-wheelbase nosewheel undercarriage and a number of detail features. Among the latter is the cabin door (yet another Fiberglas component) on the starboard side. It is bigger than formerly and gives access to all four seats although there is obviously a knack in entering the left-hand front seat quickly and gracefully. I found the bucket-type, upholstered-Fiberglas squab and pan most comfortable, although cabin width (41½in) is adequate rather than generous and elbow room a mite restricted. Each front seat is adjustable through 4½in and this seems to leave plenty of foot room for rear-seat passengers. Farther aft again is a baggage compartment of really useful proportions and with a capacity of 186lb.

The cabin is shown in the accompanying photograph. Considerable efforts have been made towards logical grouping, particularly with engine instruments and controls (which are respectively in a common, not-particularly-easy-to-see temperature-pressure group under the ram's horn wheel) and in a control-and-associated-instrument central panel. For the fuel-injected engine there is a vernier fuel-pressure control and another vernier on the r.p.m. control for the McCauley constant-speed propeller; there is no vernier on the throttle.

Good though most of the cockpit is, one or two of its features are rather disappointing. Light switches and circuit breakers are rather oddly placed by the pilot's left leg and the flap indicator is set almost out of sight behind the front passenger's right knee. Tank selector switch (two 16gal wing tanks, 17gal auxiliary tank) and levers for the hydraulically operated flap and undercarriage, on the other hand, are quite well placed between the seats.

Starting and taxying are completely straightforward and easy and the take-off check too simple to be worth special description. Brakes are adequate, act differentially and supplement the effective nosewheel steering.

I knew I was going to like the Bellanca the instant I opened the throttle. Directional control was at once effective and at about 60 m.p.h. the 260 would wait for me no longer but flew itself directly off the ground. Performance is little short of astonishing. At climb power at 120 m.p.h. it will lift off from sea level at nearly 1,700ft/min and even throttled back to a 55 per cent power setting it will, I found, slip through 1,000ft in 1min 15sec. On that hazy morning it was an instrument climb-out, with the nose thrusting steeply upwards.

The impression which the Bellanca gives of high power—almost of being over-powered—is heightened by a good deal of roughness and noise from the engine, a fault which, it seems, must be due to the lack of suitable mounting dampers rather than any inherent lack of smoothness in the power unit itself. For cruising it was pleasanter and a great deal quieter to throttle back to 55 per cent power. At 3,000ft at this setting the Bellanca quickly accelerated to 175 m.p.h. and when I later increased power to the 75 per cent notch speed rose to 185. This was at 3,000ft and thus at a relatively uneconomic altitude. It is claimed that at 63 per cent power at the full-throttle height of 10,000ft a cruising true airspeed of 196 m.p.h. can be obtained with a fuel consumption of 19.6 a.m.p.g.

While vision sideways and downwards to the left is quite good, elsewhere it is rather poor. The high instrument-panel coaming and a low roof-line, rather wide pillars, and struts and anti-dazzle curtains, tend to blank off a good deal of forward, rearward and even azimuth view. Controls on the other hand are delightful—particularly the ailerons, which are very powerful indeed. I estimated that at its manœuvring speed of 115 m.p.h. the Bellanca would roll through 90° in less than 3sec, and lateral damping was very low. The elevator is also light and remains responsive from the highest speeds right down to the stall. The rudder is effective—although not much needed—and requires rather heavy footloads. This combination of forces adds up to a very pleasant feel. In contrast with the excellent primary controls, the roof-mounted elevator trim—in spite of a large tab—is ineffective over the centre of the range. Another criticism is that the winder pivots on a fore-and-aft axis, so that the control does not operate in a representative sense. The indicator suffers from backlash.

The stall is innocuous; the wing-mounted bleeper peeps plaintively at $Vs+10$ m.p.h. and breakaway at 4,000ft occurred at about 60 m.p.h., very gently and with a slight dip of the left wing. Subsequently I selected 30° flap and lowered the undercarriage with the side-by-side floor-mounted levers and tried again. The Bellanca broke gently to the right at 52 m.p.h. i.a.s. and still left me with aileron control.

In spite of light control forces the 260 cannot be said to lack stability. At 180 m.p.h. a 5 m.p.h. speed increase was completely damped after two slow phugoids. The three fins have a marked effect on directional stability and even when yawed through considerable angles the aircraft returns decisively to its former heading. In contrast, roll stability is marginal. Back on the circuit the Bellanca has a happy downwind speed of about 100 m.p.h., although the wheels can be lowered at about 120 and flaps at 110. The latter rocket down their full travel in only 2.6sec, but the trim change is very small indeed. There is no surplus of flap and the approach at 80 m.p.h. and then 70 over the hedge is not particularly steep. The Bellanca settles best (and the tendency to pitch fore and aft on the rather short-wheelbase undercarriage is reduced) if it is set down at just above the stall. This is easy enough with such a powerful elevator, but stall warning at $1.2Vs$ is then unpleasantly intrusive.

The Bellanca cannot be summed up in a few words. Like its external appearance, it is a mixture, easy to criticize in detail yet in most respects extraordinarily good. Dynafocal engine mountings and other current design changes could effect a substantial change in the rather disappointing impression of engine roughness. At £9,105, import duty paid but without radio, it represents good value. Its high cruising speed, undoubted aerodynamic efficiency and pleasant controls add up to make it a pilot's aeroplane out of the normal rut.

Downer Aircraft Industries Bellanca 260

Dimensions: Span, 34ft 2in; length, 22ft 11in; height, 6ft 4in. *Weights:* Gross, 2,700lb; empty, 1,700lb. *Performance:* Best cruise at 75 per cent power, 203 m.p.h.; ceiling, 22,000ft; take-off, 390ft; landing, 460ft.

"Flight" photograph

Visible in this picture are the circuit-breaker panel (by the pilot's left knee), fuel-tank selector between the seats and the extendable emergency hand pump for the hydraulically operated flaps and undercarriage. Radio equipment fitted is a Narco Mk V and Omnigator

These photographs of the FS.24 Phönix 16-metre sailplane, described in the first news-item on this page, were taken at the Hanover Air Show. Particularly notable in the close-up above is the surface finish of the wing. The background machine in the left-hand photograph is the 14 h.p. two-stroke-powered version of the French Fauvel AV 36 single-seat glider

Sport and Business

ON VIEW at the recent Hanover Air Show was one of the prototypes of the German Phönix sailplane, a modified version of which is to be flown in the World Gliding Championships next month by the present champion, Ernst Haase. The Phönix was not designed for maximum penetration and, while its high-speed performance is inferior to that of such aircraft as the Olympia 419 and Skylark 3b, it can make slow, tight circles in weak thermals and can achieve a useful average cruising speed. The aircraft has a low wing-loading (18.5kg/m^2), achieved by a very light structure which combines glass cloth, polyester plastic and balsa wood; a special laminar wing section; and extreme attention to the elimination of parasitic drag.

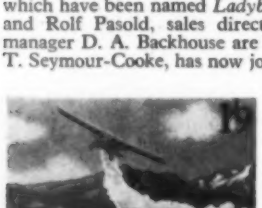
As the photographs above illustrate, the surface finish on the wing of the Phönix is excellent. The new version to be flown by Haase will have a tee-tail, slightly greater wing dihedral, a free-blown canopy and a fully retractable wheel (with no skid), together with a number of other detail changes instigated by Haase. With this aircraft, it is estimated, a gliding angle of 1:42 can be achieved. The Phönix was exhibited at Hanover by the Bölkow organization.

TWO AEROBATIC COMPETITIONS were held last month by the Tiger Club. On April 16 the contest for the de Havilland Trophy was won by Charles Boddington, with John Ayres second and John Wardley third; and on April 18 Boddington was again the winner, this time in competition for the Esso Tiger Trophy. Second and third on this latter occasion were Elwyn McAully and Lewis Benjamin respectively.

A BBC TELEVISION SERIES which, according to the corporation, is designed "to boost young people's interest in light-aircraft civilian flying," begins on May 24. With the title *L-Pilot*, the series will comprise six weekly programmes introduced by Derek Dempster and Geoffrey Wheeler. The programmes, which are produced by Tony Arnold with assistance from BOAC, the Royal Aero Club and the SBAC, include films taken at Biggin Hill and Gatwick. Individual programmes cover the history of flying, how an aeroplane flies, take-offs and landings, applied flying (aerobatics), cross-country flying and ground control, and modern light aircraft for civilian use.

A NEW GLIDER RECORD for speed over a 100km closed circuit has been claimed in a May 10 report from Kiev by the Soviet news agency Tass. The aircraft was an Antonov A-15 and the speed was quoted as 110km/hr (approximately 68 m.p.h.).

A PIPER APACHE has been delivered to Pasolds Ltd, of Langley, Bucks, makers of Ladybird children's wear. The company has operated eight executive aircraft in succession since 1937, all of which have been named *Ladybird*. Joint managing directors Eric and Rolf Pasold, sales director L. P. Murphy and contracts manager D. A. Backhouse are all pilots, and a professional pilot, T. Seymour-Cooke, has now joined the company from BEA.



A Beaver engaged on aerial top-dressing is the appropriate subject for this stamp design, one of a series to be issued shortly by the New Zealand post office

BUSIEST DAY at the Shackleton Sales Weekend at Kidlington on May 6-8 (reported in last week's issue) was Saturday, May 7, when some 470 aircraft movements were recorded between 11 a.m. and 7 p.m.—equivalent to an average of one per minute. A total of 30 different new aircraft were on show, together with 44 used machines, while the maximum number in the visiting aircraft park at any one time was 85.

CONTACTS LTD of Limerick, Eire, have been appointed agents for the Forney Fornaire, descendant of the Ercoupe, and plan to arrange a demonstration tour shortly. Among the features of the 1960 model of the Fornaire, according to the brochure, is "the famed Simplomatic co-ordinated control for simplified flying or conventional 'stick 'n' rudder' manœuvrability."

SALES OF THE CESSNA 210 during the first quarter of this year totalled 234, a greater number than for any other type. "To insure continued acceptance of the 210," the company has instituted a new follow-up customer service programme known as "Operation Golden Rule." The Cessna agents in Britain, Airwork Services Ltd, had sold 14 machines up to the beginning of this month.

FOLLOWING A SUCCESSFUL TENDER by Howard Hughes, about 30 ex-South African Air Force Venturas have been dismantled and are being sent by sea to the United States. Hughes Aircraft Company is to strip the Venturas and re-build them to new specifications as executive aircraft.

RETROSPECT

From "Flight" of May 21, 1910

Flying Missionaries: At the annual meeting of the British and Foreign Bible Society, held in Queen's Hall last week, the Marquis of Northampton, in an optimistic speech, referred to the possibilities of aerial navigation in connection with the Society's work. He thought the time was not far distant when they might perhaps see the *colporteurs* of the Society flying through the air and dropping Testaments in those parts of the world which had up to the present proved inaccessible to the missionaries.

THE BRITISH WOMEN PILOTS' ASSOCIATION are organizing a "Spring Flying Weekend" at Skegness on May 28-29. On Saturday, May 28, Skegness Flying Club will hold its international rally and dance, and the BWPA will also run a competition for the Faith Bennett Trophy.

A FLYING CLUB has been formed by employees of Rolls-Royce Ltd, Derby, with two test pilots and 20 ex-RAF pilots among the membership. The club is negotiating for the use of an airfield near Derby and is raising funds to buy its first aircraft (a Tiger Moth).

TOMORROW, MAY 21, is an unusually busy day for sporting flying enthusiasts, with the Royal Aero Club's air touring contest at Shoreham and the summer convention of the Association of British Aero Clubs at Thorney Island. In addition to these power-flying events, Lasham Gliding Society are holding an At Home at Lasham Aerodrome, near Alton, Hants. This will begin at 3 p.m. and continue until 6.30, and the programme will include pleasure flights in the Society's gliders and an aerobatic display.

More tall tails from Boeing, for Varig, Lufthansa, BOAC and Western. By contrast the PanAm aircraft in the background is unmodified. First three in the line are all Rolls-Royce Conway-powered 707-420s; BOAC's aircraft here is temporarily Boeing-registered N5091K

AIR COMMERCE

£18M ELECTRA PROGRAMME

LAST week the Lockheed Aircraft Corporation issued a statement attributing the two Electra mid-air disintegrations* to "unpredictable and abnormal flutter." In both cases a wing broke off after fluttering at three cycles a second.

J. F. McBrearty, assistant general manager of Lockheed's California division, says:—

"In our opinion the accidents resulted from dynamic coupling at high speed of oscillatory movements of the outboard power pack nacelle and the wing. All our tests and calculations substantiate the conviction that some element of damage existed in the powerpack nacelle area of both Electras prior to their accidents. This damage by itself could not have caused destruction, but the combination of broken or weakened elements plus the external forces intensified by high speed built up the forces to the breaking point. Modifications are under way which will preclude the possibility of such a coupling of forces . . . All tests and supporting calculations show that the low speeds at which Electras are now flying will prevent a repetition of this phenomena, and all chance of a recurrence of dynamic coupling at higher unrestricted speeds will be eliminated under the modification programme."

Some 250 Lockheed engineers and technicians worked virtually day and night on what the manufacturer describes as "one of the most profound engineering problems that has confronted our company in three decades." A model of the wing, power units and nacelle structure was built and tested in the Lockheed wind tunnel. It displayed normal stability at all speeds and against external disturbances, including gusts, while the structure was undamaged. The stiffness and bending strength of the combined nacelle and power unit were then gradually reduced, permitting an excessive movement up and down as well as sideways, to simulate the effect of structural damage "such as might result from an abnormally hard landing." Under such conditions a point was finally reached in which the weakened model began to oscillate and become unstable. The movement continued and set up similar oscillation of the wing. Lockheed say that in an Electra without a damaged part in the power unit and nacelle area oscillations would damp out or disappear but when the structure was damaged they would continue unchecked. "In the case of the two accidents they increased by combining or coupling."

Design change proposals along with other modifications "not connected with the accident but normal product improvements" are shortly to be submitted to the FAA; after Agency approval they can be carried out in the field to the 145 Electras now in service. This work could begin in July.

Summing up the Electra investigation for the record, it was evident from early wreckage analysis of the two mid-air disintegrations that wing failure had been a primary cause. Immediately after the second accident the FAA imposed a speed limitation of 275kt i.a.s. at cruising height; on March 26 this was further reduced to 225kt—an 80-100kt penalty. US Electra operators concerned (Eastern, American, Braniff, Northwest, Western, National, Pacific, Southwest) are reported to have suffered, in varying degree, loss of business.

The Lockheed investigation, which has been reminiscent in scale and intensity of the Comet 1 investigation in 1954, involved air tests of the prototype which was flown "very close to the design limits." Lockheed test pilots and engineers flew the aircraft into areas of extreme turbulence over the California mountains, putting the aircraft through high g manœuvres at various weights and speeds. In addition, a Northwest Electra with about the same flight time as the aircraft that crashed on March 17 (reportedly less than 100hr) was thoroughly inspected. Also participating in the programme were Allison, Aeroproducts and, in addition to the FAA, the NASA. The cost of the investigation is reported to be about $25 million (nearly £9 million). That figure was given on April 19; on May 12 Robert Gross, Lockheed's chairman, estimated that the cost of the modification programme would not exceed $25 million—i.e., about the same amount again, a total equivalent to about £18m.

These heavy costs will presumably be borne by the manufacturers, and they are in addition to the expensive engine tilt-up programme found necessary a year ago to eliminate severe vibration. The cost of those modifications is not certain; but when added to the recent costs it is probable that Lockheed are still some way from breaking even on the Electra programme.

** September 1959, Braniff Electra near Buffalo, Texas: 23 passengers and six crew killed; March 1960, Northwest Electra near Tell City, Indiana: 56 passengers and six crew killed.*

HONG KONG FOR NORTHWEST

IT now appears probable that Northwest Airlines will be granted their long-sought demands, hitherto always firmly resisted by the British Government, for an extension of their US - Tokyo service to Hong Kong. A report from Washington says that the British delegation "is believed to have conceded this in principle." At the same time, the State Department is reported to have been asked to "defer to a later date" TWA's request for beyond-rights from London—another highly controversial point at issue since 1956 between the civil aviation authorities of the two countries.

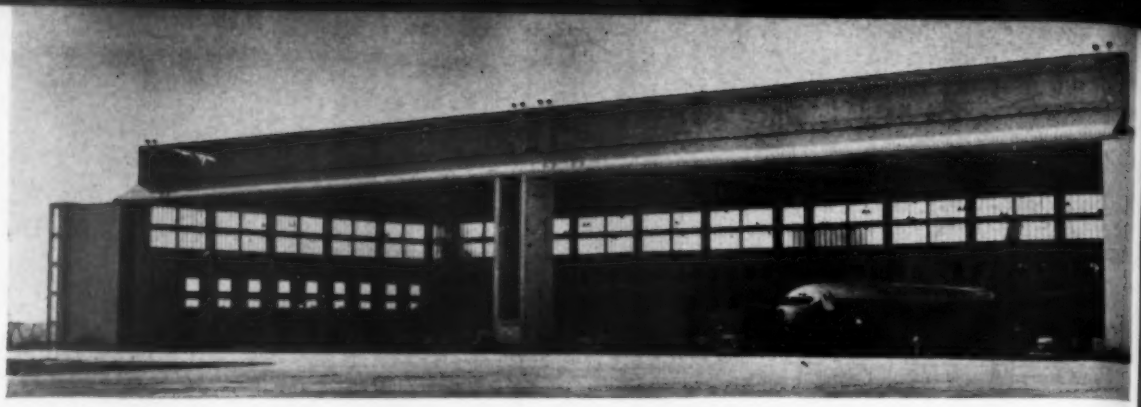
Meanwhile negotiations are said to be continuing on Eagle's request for rights between the Bahamas and Palm Beach and Fort Lauderdale. This airline's Viscounts already connect Nassau with Miami; but, due to the vigorous resistance of the US carrier Mackey, it has so far been unable to link the Bahamas with the other two Florida resorts. The difficulty here is partly one of getting the Americans to agree to "double designation," since Eagle's British competitor Bahamas Airways already serves the points concerned.

Another agreement in principle is reported to be that BWIA are to be designated as the carrier to run non-stop services between New York and Jamaica, rights now enjoyed by PanAm.

THE BILL IN THE LORDS

SECOND skimming rather than second reading might be a fair way to describe the consideration given by the House of Lords to the Civil Aviation (Licensing) Bill last week. The best feature of the 1hr 20min debate was the summary of the main points and purpose of the new legislation by the Paymaster General, Lord Mills. As a concise account of Britain's proposed new civil aviation legislation it can be highly recommended.

Unfortunately, subsequent speakers offered no fresh thoughts of any depth: one noble lord, a Labour Government Minister of Civil Aviation a decade ago, did not "quite see the point that the Air Transport Licensing Board should have the general duty of furthering the development of British aviation"; he thought this was the duty of the Ministry. He also thought that "jet-sustained wingless vehicles" which would be "driven along the road when necessary and taken up into the air when necessary," would "alter completely the whole situation so far as air transport is concerned." He also complained about the lack of air ferry services between Wales and Ireland, and the neglect of Rhoose Airport. But few specific criticisms of the Bill were offered, and it was a pity that Lord Terrington, because he is chairman of the ATAC, could not contribute. The Bill will now be considered in committee.



New for Air-India at Santa Cruz, Bombay, is this reinforced concrete hangar for their Boeing 707-420s. The consulting engineers were Donovan H. Lee and Partners of London and Sydney. Air-India introduced the Conway-powered 707 to transatlantic service last Saturday

AIR COMMERCE . . .

ACCIDENTS AND TECHNICAL EVIDENCE

A FEW weeks ago (April 1 issue) there appeared in *Flight* an article ("After an Accident") by Capt C. C. Jackson. In a detailed reply (April 29 issue), Walter Tye, chief technical officer of the ARB, took the author to task for questioning the reliability of evidence on performance as given by ARB witnesses at Courts of Inquiry, and for the implication that certification techniques were of a freak variety. Not satisfied that the last word has now been said, Capt Jackson has sent us the following rejoinder.

"I would certainly agree with Mr Tye," writes Capt Jackson, "that the ARB has moved further than anybody towards making test techniques representative of airline flying. This may in the future take care of the problem of providing accurate data for Courts of Inquiry when dealing with aircraft certificated to the new code. However, the aircraft whose performance data I questioned were certificated to pre-1951 BCARs and these were not specific in demanding a net rate of climb on engine failure at or near take-off weight or an airline technique for measuring landing distance. Moreover, although the latest BCARs provide for an airline technique in measuring landing distance, they permit an option for the old technique, which is well known to have resulted in serious damage to aircraft during certification tests—in other words 'freak' techniques. I understand that no manufacturer has yet elected the new 'rational' method of measuring landing distance and to that extent, therefore, it would be as well to check even on new British-manufactured aircraft whenever landing distance or approach speeds might be a factor in the accident.

"Incidentally this applies even more so to foreign manufactured aircraft, some of which are certificated on a devalued assessment of the stall (cutting in dangerously at 1.3 *Vs* on the approach). And it must be remembered that British Courts of Inquiry will be dealing with foreign as well as British-manufactured aircraft.

"But the above are areas where Mr Tye and I are, I hope, likely to agree and I would say at once that I have the greatest admiration for the ARB officers who have since 1949 worked towards more rational requirements in the field of sub-sonic performance certification, sometimes with little encouragement from the home industry and, until recently, with active opposition from the US. However, that does nothing to prove that much of the evidence on performance apparently accepted by Courts of Inquiry has been of doubtful value.

"As this is an important matter, I will give a few instances. In the report of the inquiry into the accident to Viking G-AIJE at Southall on September 2, 1958, the Commissioner does not state the net (or gross) climb to be expected from a Viking (overloaded at take-off by about 400kg) on losing an engine 15min after take-off; instead, he refers generally to evidence of performance from 'a number of experts' (including, presumably, the ARB) and of a pilot who a few days earlier flew the same aircraft and obtained an engine-out climb of 600-700ft/min. But the take-off weight of this aircraft is not stated—except that it was 'very lightly loaded.' Now this is poor stuff by any standards. Any twin will climb with one out if it is light enough and the fact that this test had been taken into account by the Commissioner as substantiating a positive climb confirms my recommendation that Commissioners should have a wide background knowledge of the industry. I have not the transcript of the proceedings before me but I recall that, at the Coroner's Inquest preceding the above Inquiry, Mr Tye gave the engine-out rate of climb as about 100ft/min. This is a derisory figure by piloting standards and in my view should immediately have evoked a cross check. This would have settled one way or the other the uneasiness in minds like my own which recall the following additional accidents where a Viking lost an engine early after take-off, failed to hold height, crashed, and for which the pilot was blamed.

"On August 15, 1954, Viking G-AIXS, returning to Blackbushe after engine failure, lost height and, failing to stretch the approach enough, crashed short of the runway. Similarly on May 1, 1957, Viking G-AJBO (taking-off a little overloaded) also returned towards Blackbushe after engine failure, failed to hold height and crashed. Now I am aware that pilot technique was held to be deficient in both of these cases; but would it not have been in the interests of a thorough inquiry to see if the aircraft actually would have held height in any circumstances and to determine whether the associated piloting technique was a reasonable one? In this connection I am reminded of the accident to Viking G-AHPD at Bordeaux on May 8, 1951. This aircraft also lost an engine shortly after take-off, failed to hold height and crashed. On this occasion the inquiry was conducted by the French authorities. They appear to have accepted that the aircraft would under the circumstances only go downhill: they did not blame the pilot but, with a truly Gallic logic, attributed the accident to the disconnection of the articulated control rod of the propeller governor.

"Referring to the accident to the York at Malta on February 18, 1956, this aircraft was certificated to 68,000lb; it was about 660lb overloaded and the report indicated that the first signs of engine malfunction were experienced at or near the unstick point. Shortly after, it experienced engine failure, lost height and crashed; at the inquiry the pilot was blamed for allowing the aircraft to stall. Now I myself flew the York when its maximum weight was 66,500lb and I would have been a very worried man on losing an engine near unstick. At 68,660lb I have very much doubt if anybody could cope and, bearing in mind the terrain of Malta, there must have been a strong compulsion to stay in the air as long as possible.

"All I am asking for is positive information that the above aircraft would, in the circumstances of the above accidents, go uphill and not down. It makes a difference. I find no adequate reassurance in the reports and I would suggest that future Commissioners dealing with this type of accident include a profile of calculated net and gross gradients in their analyses (and reports); if fully satisfied with these, select a fleet aircraft of the type in question; put the Court on board up to the appropriate load (if this is an overload, fly at reduced power accordingly); and then fail an engine shortly after take-off. After all, this is not asking anything unusual, since Mr Tye himself states in his letter that the performance of each aircraft is submitted to a regular cross check.

"But do not misunderstand my viewpoint here. I am out to get more thorough and better-balanced accident investigations; to do this, one has to be specific. It is no good beating about the bush and generalizing if we are bent upon true reform, which would undoubtedly call for legislation. I trust, therefore, that my views will not be taken personally in any quarter. In the Moody and Sankey Hymnal you will find many beautiful hymns by John Newton, whom our forefathers undoubtedly held in great respect; but John Newton had part shares in a slaver. I mention this to illustrate how our ideas on ethics change. They change similarly in respect of airworthiness. But let us not whitewash the old standards. We should have routed them out before. For not acting previously, the pilots will, I feel sure, be willing to accept as much responsibility as the airworthiness authorities. Anyway, I will."

BRITISH FRIENDSHIP PRODUCTION?

WITH Fokker-Fairchild F.27 Friendship orders now in the 160s and about 175,000 hours' route experience to back sales propaganda, Fokker are looking for new customers. With an eye on British independent operators they brought one of the F.27 prototypes (PH-NVF) to Gatwick last week for demonstration flights.

Although Fokker have not yet been able to announce any UK customers, though emphasizing that at least 35 per cent of the Friendship is British, they have made an approach to the Minister of Aviation to allow licence-production of the aircraft in Britain. This was announced at a luncheon given in Le Touquet on Tuesday last week on one of PH-NVF's demonstration runs. There was nothing very specific about the announcement, beyond the implication that Duncan Sandys had raised no objection; no British firms were mentioned as potential Friendship producers, and the number of those not already in direct competition (Hawker Siddeley with the Avro 748 and Handley Page with Dart Herald), or otherwise reluctant to put a third British contender on the DC-3 replacement market, is severely limited. But the announcement indicates the way Fokker are thinking; and their attitude towards European co-operation in aircraft production is one to which Mr Sandys would presumably subscribe.

SAS and the Caravelle

COST comparisons based on operating experiences with Caravelles and DC-7Cs on a typical European - Middle East route showed that the variable operating cost per round trip and per seat mile were 20-25 per cent less for the Caravelle than for the DC-7C. These conclusions are stated by Knut Hagrup, engineering vice-president of SAS, in an article in the April issue of *Shell Aviation News*, in which he discusses the airline's experience with the Caravelle.

SAS chose the Caravelle in 1957 on the basis of size, speed, range and delivery dates. Some airlines, writes Mr Hagrup, are reported to have said that modern aircraft should have "less than four engines and more than two" but he wanted to modify this statement by saying that the optimum number of jet engines for a short-range jet aircraft is more than one.

Frequent stops on flights between Scandinavia and the Middle East, he goes on, have posed something of a catering problem. In attempting to satisfy the needs of both long- and short-haul passengers light meals were served on every leg and second helpings made available. Passengers received a menu listing all courses to be served during the entire flight so that short-haul passengers could always go for a light meal and long-haul passengers could determine for themselves when they wanted their main meal.

Pilot reaction to the aircraft had been "extremely favourable"; the quietness of the cockpit helped reduced fatigue. Approach speed for the Caravelle was similar to that of SAS's DC-6B and DC-7C except that "we maintain minimum final approach speed from the outer marker with the flaps fully down." This gave a low approach speed but called for extra precision in flying. Use of the braking parachute for reducing speed on wet and icy runways had proved very effective; no sudden deceleration occurred but there was a feeling like hard wheel braking. Time of acceleration to 90kt was used on each take-off in order to monitor take-off performance and had been found to be exact.

Discussing the technical performance of the Caravelle Mr Hagrup produced the following table:—

Aircraft type	Flight hours per month	Flight time per take-off (hr)	Technical delays (more than 30min) per 1,000 take-offs	Malfunctions per 1,000 take-offs
CV-440	3,850	1.00	9	340
DC-6	1,356	1.33	16	540
DC-6B	4,330	3.50	38	940
DC-7C	5,632	5.55	77	1,540
Average	3,792	2.85	35	850
Caravelle	856	1.34	47	700

Average daily utilization of four aircraft during the summer of 1959, said Mr Hagrup, had been 7.41hr—rather good considering that one of the aircraft had mostly been used for training. The DC-6s and DC-6Bs each now had total flight times of over 20,000hr and the DC-7Cs over 7,000hr. Technical delays per thousand take-offs did not look particularly good for the Caravelle but the very quick turn-round made less time available for repair and the small number of aircraft had made it difficult to organize reserves. "We are confident" said Mr Hagrup, "that the Caravelle will be superior to our present aircraft."

EAST GERMANY'S VEB-152

BELOW is a *Flight* airline operator's reference drawing of the Flugzeugwerke Dresden VEB-152. The aircraft is destined for service with the East German Deutsche Lufthansa which now operates to Western Europe under the name Interflug. Information for this drawing originated from the manufacturers, and new data supersede those given in the "Commercial Aircraft of the World" special issue of *Flight* (November 20, 1959). Take-off weight is either 105,800lb or, in another version, 112,400lb. The standard layout now seats 58 passengers instead of 57 and an all-tourist configuration 73 instead of 72. An all first-class version seats 48.

The drawing conforms with the standard style adopted last year and figures in the key allow comparison with nine other types drawn to the same scale in *Flight* for November 20, 1959. Another operator's drawing, for the ATL-98, appeared in the issue of February 19 this year.

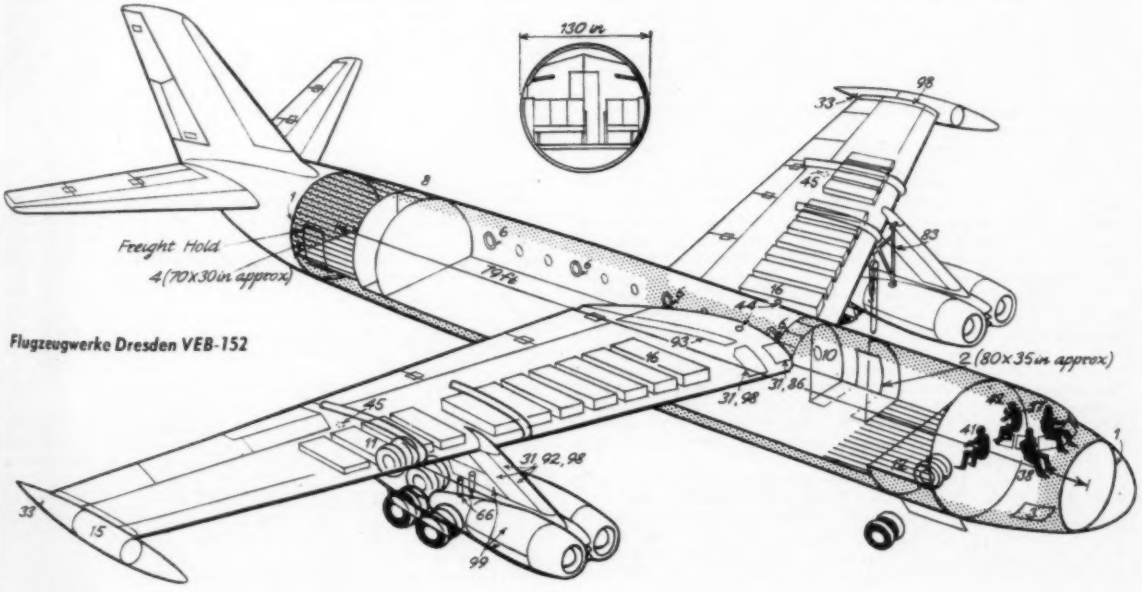
Principal Data

Powerplant: Four Pirna 014 A-1 of 7,270lb thrust. *Dimensions:* Span, 86.6ft; length, 107ft. *Weights:* Max. take-off 112,400lb; operating weight empty, 63,500lb; max. fuel, 34,027lb; payload, 20,422lb.

Payload Accommodation: Cabin volume, 2,472 cu ft; cabin length, 79ft; fuselage diameter, 10.8ft.

Performance: Cruising speed, 432kt (500 m.p.h.) at 30,000 to 35,000ft; landing speed, 110kt (127 m.p.h.); take-off to 50ft at max. weight, with failure of critical engine, 6,000ft; range with max. payload, no allowances, 1,864 st. miles; range with max. payload, 1,400 st. miles.

1 Pressure bulkhead
3 Crew door
6 Emergency exit (window)
8 Fixed toilets
10 Galley, pantry or buffet
11 Main undercarriage well
12 Nosewheel well
15 Integral fuel tanks
16 Bag tanks
31 De-icing system access
33 Fuel jetison
37 Captain
38 First officer
41 Engineer
42 Radio operator
44 Gravity fuel fillers
45 Pressure fuelling/de-icing equipment
66 Fire suppression bottles
83 Engine hoist
86 Flying control access
92 Fire access
93 Access to wing joint
98 Fuel-pipe access
99 Engine access



The Port of New York Authority is noted, among other things, for the quality of its air-ground photography, to which this recent picture bears witness. A Pan American Boeing 707-320 climbs away from New York International's runway 25 towards Jamaica Bay

AIR COMMERCE . . .

"X" AND "Y" LICENCES

BRITISH air transport will not stop while the new legislation (see p. 697) goes through Parliament, and the Ministry has accordingly made arrangements for transitional licences to be granted. When the Civil Aviation (Licensing) Bill becomes law, closed-group "separate-fare" operations—at present unregulated and becoming increasingly open to abuse—will require an air service licence. In the meantime operators and travel agents who are planning closed group operations at separate fares (a term now defined by the Ministry) will want to know where they stand.

What they are now required to do is to submit their case before June 23 to the ATAC, who will then recommend the issue or refusal by the Minister of a transitional licence, which will be in either category "X" or "Y."

An X licence will apply to closed group operations, the terms of which are carefully defined and limited by the Ministry ("closed groups must have a genuine independent existence," etc.), and which can henceforth no longer be advertised. A Y licence will be issued, again subject to carefully defined conditions, to inclusive tour or circular tour operators under arrangements already announced by the ATAC. ITs and circular tours have, of course, already been controlled by the ATAC.

Requests for X and Y licence application forms should be made to the Air Transport Advisory Council, 3 Dean's Yard, Westminster, SW1.

COMET 4 OPERATING TECHNIQUES

AN increase of 5kt in the flight manual approach speed of the Comet 4 is one of the amendments made to the operating techniques of this aircraft—changes referred to by the Parliamentary Secretary to the Ministry of Aviation, Geoffrey Rippon, in the Commons last month (*Flight*, April 22, page 577). Mr Rippon, it may be recalled, was answering questions about BOAC Comet 4 incidents, of which he noted that there had been five, including four in the landing or approach phase. He said that operating techniques had been "reviewed and amended," and would be "further examined when we hear the report of the fifth accident in Madrid."

According to BOAC, the 5kt increase in approach speed was made as a result of the landing accident at Calcutta in June 1959, when a BOAC Comet 4 struck trees on each of two approaches, causing damage to the flaps and a subsequent fast landing and overshoot on a wet runway. This extra margin of speed during a final approach will take care of unexpected turbulence which, it is believed, contributed to that incident.

Other amendments, according to BOAC, include (1) Changes in the approach flap configuration following a collision in June 1959 with a fence on the approach at New York. (2) Installation of an undercarriage horn warning system as well as flashing light system, and an alteration in the check list, following the incident at Rome in October 1959 when a Comet 4 landed with gear retracted. [Hitherto horn warning, an FAA requirement, has not been fitted to BOAC Comets.] Henceforth, if 40° of flap is selected with undercarriage retracted, the pilot will get audible as well as visual (flashing light) warning. (3) A time interval has been prescribed to allow brakes to cool after an abandoned take-off, following damage caused at Beirut in February 1959 when the tyre of a retracted wheel burst, causing damage to the wing structure, after a first take-off had been abandoned.

For the moment the corporation's investigation of the Madrid incident has not been completed, and the matter is therefore *sub judice*. No injuries have been caused to crews or passengers in any of the BOAC Comet 4 incidents.

BELATED BRITANNIA ACCIDENT REPORT

NO firm conclusion about the cause of the accident to G-ANCA, the 300-series development Britannia, at Downend, near Bristol, on November 6, 1957, has been reached in the official report,* published 2½ years after the event. The captain, E. H. Statham, assistant chief test pilot of Bristol Aircraft, three other crew-members and eleven technicians all lost their lives. P. G. Tweedie, chief inspector of accidents at the Accident Investigation Branch, Ministry of Aviation, gives as an opinion "the possibility that the accident occurred as a result of the malfunctioning of the autopilot cannot be dismissed."

G-ANCA was returning to Filton from a development flight to strain-gauge the forged Duralumin propeller on No 2 engine. As the aircraft turned on to base leg the right wing dipped and it went into a steeply banked right turn. It recovered substantially and broadcast a Mayday call, but afterwards banked again and struck the ground.

The scattered wreckage was collected and laid out in a hangar at Filton. Later it was taken to the structures department, RAE Farnborough, where a partial reconstruction and a detailed examination were made.

No pre-crash failure or defect in the structure or flying control circuits was found and it was established that no asymmetric operation of the flaps had taken place, nor were defects found in either the propellers or engines. But part of a flight test observer's log which was recovered showed that the aircraft had exceeded its speed limitations.

At RAE it was found that the main control surfaces, their tabs and trimming circuits were near to the neutral position, and there was no evidence that a hydraulic control lock had inadvertently operated. Included in the examination were the electrical and autopilot systems. In the latter, signals from gyro units energize elevator and rudder servo-motors which are connected to their respective main control circuits by shafts, levers and push-pull rods. The rods are force-limiting links incorporating a pre-load spring, deflection of which operates an electrical cut-out switch connected to the electro-magnetic clutch of its associated servo motor. Into each of the servo-motor shafts is turned a neck which should shear if its associated reduction gear seizes. A test required a control column load of 180lb to fail the neck. There is no known case of this occurring in the air.

Inspection of the force-limiting links of the aileron control circuit showed that the ball which operates the cut-out switch had made a pattern of indentations on the shaft within the force-limiting link. It was concluded that the shear neck had failed in torsion before it was damaged by impact. It was established that the autopilot switch was "off" at the moment of impact but that the gyro rotors were rotating, although not under electrical power at that moment. This suggests, says the report, that they were "running down" after having been switched off just before the accident occurred.

Nothing was found to indicate that the servo-motor clutch had remained engaged after the autopilot had been switched off, but it was the conclusion of the RAE that the autopilot aileron channel was damaged before the crash in a manner consistent with failure to disengage. This was thought to be most likely due to some undiscovered fault acting in conjunction with a "known design fault in the electrical circuit of the autopilot flight system." The known fault, discovered on January 10, 1958, in an incident to another Britannia (G-AOVG), referred to single-pole instead of the intended double-pole operation of the aileron servo-motor clutch. In this the force-limiting link was not indented, neither

*"*Civil Aircraft Accident: Report on the Accident to Britannia G-ANCA.*" Price 3s, HM Stationery Office.*

did the servo-motor shaft neck shear. The same electrical fault existed in G-ANCA.

A report on tests carried out by the autopilot manufacturers notes that "The servo-motor mounting output shaft can be sheared and ball indentations can be produced on the force-limiting link shaft, due to impact damage in either compression or extension with the servo-motor electrical clutch disengaged."

Considering the accident as a whole, says the report, the balance of evidence is not inconsistent with malfunctioning of the autopilot, although there is no conclusive proof of this.

WIDE CUT AIRLINES

MOST controversial of the subjects discussed by IATA's Technical Conference in Lucerne (page 667, *Flight* last week) was the proposal for more widespread airline use of JP.4 wide-cut gasoline. Engine manufacturers and oil companies are shortly to be asked to approve a JP.4 specification and a statement of requirements wide enough to embrace both aviation gasoline and kerosine. This might make it possible, the conference argued, for airlines to use special fuel on different routes, so increasing payload and operating range. That was one economic consideration; the other was that the total fuel bill was now about 15 per cent of all operating and maintenance costs and when jets were fully in service it might rise to 30 per cent.

The committee studying jet fuels commented that fluctuations in price and local supply made it economically desirable for both fuels to be used at different times or even together; elsewhere—and apparently contradicting this—they remarked that mixing of even small percentages of kerosine with gasoline was undesirable.

The jet-fuel committee was led by Knutt Hagrup of SAS, chairman of the Conference. Other particularly busy men were E. L. Killip of BEA and H. E. Smith of BOAC. The latter chaired a committee which tackled *Air Traffic Control and Associated Services*, while Mr Killip led committees studying *Doppler Radar Navigation Systems* and *Presentation of Flight Information*.

The Doppler study occupied a substantial part of the Conference. In operational use, the airlines reported, Doppler accuracies were of the order of 1 to 1½ per cent along the track and 3½ to 4 per cent across it. Careful correction of compass error (compass heading references used with Doppler are generally correct to within ±2°) should greatly improve its accuracy. The benefits of Doppler should be reduced horizontal separations and shorter flight times as a result of a better knowledge of winds.

The Conference might be summed up in the chairman's words: "Instead of spending much of our time discussing [piston] engine troubles as in the past, we have been able to concentrate on questions . . . in regard to aircraft and their systems."

PROMOTION FOR MR GRANVILLE

A POINT that is not yet clear about Keith Granville's appointment as chairman of BOAC Associated Companies Limited is whether a top-level executive link will be retained between these companies and the parent corporation. Sir George Cribbett, whom Mr Granville succeeds, was also deputy chairman of the parent corporation, providing the necessary continuity of policy. Keith Granville now relinquishes his appointment as deputy managing director of BOAC, though it is presumed that he will remain active as a director of the parent corporation.

Mr Granville takes the chair of associated companies whose affairs have been left by Sir George Cribbett in a promising, though not yet profitable, state.

BREVITIES

Two Avro 748s appear in the current issue of the British Register of Civil Aircraft. The first is G-APZV (constructor's number 1534) and the second is G-ARAY (1535).

Commanders of the BOAC Britannia which flew the Queen Mother from London to Salisbury on May 10 were Capt J. T. A. Marsden and Capt B. E. P. Bone.

TWA announce faster North Atlantic 707 schedules (see page 677). Two round trips a day will now be operated, scheduled 7hr 25min westbound (15min faster) and 6hr 30min eastbound (10min faster).

Latest pilots' association to claim increased pay for jet flying is the South African Airways Pilots' Association. It is claiming £4,500 a year for senior 707 captains; highest-paid skippers at present receive just over £3,000.

CPAL have decided to purchase the Canadian Marconi Company's Doppler equipment CMA-623, together with the associated computer. The equipment is for installation in CPAL DC-8s; deliveries will begin in August.

London Airport's runway 10L/28R is back in service with improved lighting, and with preparatory work completed for the visual glide-path indicators soon to be installed. Pilots' opinions of the new lighting should be made either to London Airport ATC or to the AIS.

Last Tuesday, May 17, marked the 40th anniversary of KLM's London - Amsterdam service. It was celebrated by a special DC-8 flight on board which were Capt "Jerry" Shaw, who on May 17, 1920, piloted the first D.H.9 flight (he is now with D.H. Aircraft), and Sir Frank Whittle, who named the aircraft *Sir Frank Whittle* at LAP.

The Cyprus authorities have refused permission to Falcon Airways to operate cheap-fare services (£45 return compared with the standard BEA night tourist £85 return) for Servicemen and their families between Nicosia and the UK (*Flight*, April 15). The official explanation is that the flights "would not be in the public interest."

Though at first said by TWA to have suffered undercarriage collapse, the 707 which made a crash landing at New York International on the afternoon of May 9 was, the airline said later, on the point of retracting its gear prior to going round again. After the approach had been completed the commander, Capt Harry Campbell, decided to "abort." Retraction of the landing gear was started but the aircraft touched down on the runway as the gear was retracting. The aircraft skidded to a standstill on Nos 2 and 3 engine pods, causing fire. This was quickly extinguished, and none of the 100 passengers or crew of nine was injured. The aircraft skidded for about 2,000ft and came to a stop only 300ft from the sea at the end of runway 22R. Though the pods were badly damaged they were not torn off.

Appointed honorary chairmen of the Institute of Air Transport (ITA) in Paris are Prince Bernhard of the Netherlands and Prof Theodore van Kármán.

The Belgian Government is planning to increase its interest in Sabena from the present 51 per cent to about 80 per cent in line with the government participation in the other Air Union member-airlines, Air France, Alitalia and Lufthansa.

Now being operated by DC-6Bs of SAS is Thai International's new service between Bangkok, Hong Kong, Taipei and Tokyo. There are five weekly round trips between Bangkok and Hong Kong, and three weekly services between the British Colony and Tokyo—two via Taipei.

June 3 is the date set by SAS for the inauguration of DC-8 trans-polar flights between Copenhagen and Los Angeles. On board will be Princess Margarethe of Denmark, Princess Astrid of Norway, Princess Margarethe of Sweden and Prince Axel of Denmark. The Princesses will visit the Douglas plant in Long Beach to inspect DC-8 production.

Last Tuesday, May 17, the extended main runway at Prestwick Airport was formerly inaugurated by a BOAC Boeing 707 on a proving flight to London from Toronto. The extension of the runway to 9,800ft is the first phase of Prestwick's £3m development programme. Work is already in hand on the new control tower and fire station.

JAL announce a 5 per cent dividend to all its non-government shareholders for the year ending March 31, 1960. During the year a net profit of more than £230,000 was made, of which about £150,000 is earmarked for dividend. At the same time JAL have increased their capital from £9.4m to £10.9m; part of this will be used to finance JAL's initial payments for three Convair 880s.

BEA have put back by a year their plans to inaugurate scheduled helicopter services in the summer of 1961. A spokesman says that no decision has yet been made as to which helicopter will be chosen from among the Sikorsky S61, Vertol 107, the Bristol 192C and "a new Westland helicopter." This is the first time that BEA's consideration of a Westland helicopter has been referred to.

In an unusual, if not unprecedented, action, the Italian authorities seized an Aerolineas Argentinas Comet 4 at Rome Airport on May 14. They acted under an order by a Milan court in a lawsuit brought by an Italian industrialist, Francesco Gronda, against the Argentine Government (owners of the airline) in respect of £11.5m allegedly owing for the construction of an aluminium factory in Argentina. The Comet 4 was released two days later.

"Flight" photograph

Last week in Philadelphia "Flight's" camera recorded this arrival from Pittsburgh of one of Allegheny's "no reservation" commuter services by turboprop Convair 540. Forty people disembarked, typifying the high load factors achieved. We hope to review this Napier Eland-powered operation, and Allegheny's progressive ticketing system, in a later issue

SERVICE AVIATION

Air Force, Naval and Army Flying News

Sir Caspar's Command

WITH the appointment of Admiral Sir Caspar John as First Sea Lord, the Royal Navy has for the first time a professional pilot in its top post. He succeeds Admiral of the Fleet Sir Charles Lambe (who has had to resign owing to ill-health) and takes up the office next Monday. Sir Caspar has been Vice-Chief of the Naval Staff since February of this year and was to have succeeded Admiral Sir William Davis as C-in-C Home Fleet this month, at the same time assuming the NATO post of C-in-C Eastern Atlantic. Described by the Admiralty as "an officer with exceptional knowledge of Naval aviation," he served in several aircraft carriers between the wars. During the Second World War he became (in 1941) Director-General and subsequently Chief Naval Representative for Naval Aircraft Development and Production at the MAP; and in 1943 head of the British Naval Air Service representation in the US. He took command of HMS *Pretoria Castle*, which had been converted for use as an aircraft carrier, in October 1944; and the following year commanded HMS *Ocean* when she was first commissioned. His post-war appointments have included command of the Third Aircraft Carrier Squadron and Flag Officer Air (Home). He is a KCB.

Western Spearhead

THOUGH now very considerably reduced in size, the Oxford University Air Squadron still has the same spirit as it did in its numerical heyday. Wg Cdr A. J. Douch, welcoming the guests at the squadron dinner for the last time (his tour of duty is almost complete) mentioned in particular the Mayor of Oxford and AVM W. F. MacNeece Foster and Air Chief Marshal Sir Guy Garrod: the last-named had been the squadron's first regular CO and has established it as part of the University. Wg Cdr Douch suggested that technical ground training should be an alternative in the squadron for those who failed in the intense competition for flying membership.

Replying for the guests the Secretary of State for Air, George Ward, congratulated Wg Cdr G. H. Nelson-Edwards, a former CO, on his single-handed coaching of the Oxford boat crew. Commenting on the recent Blue Streak controversy, he said that politicians were quite used to being "hoist with their own Hansard." The significance of the decision to cancel Blue Streak had, he claimed, been misunderstood. It had provided great scope for research but the decision to abandon it as a deterrent had been right. The argument was not about the decision itself but about the timing of it; and the Government would stand by the NATO deterrent, of which our own independent deterrent formed a part, until an effective disarmament agreement was reached.

Manned aircraft, he said, would have a much longer career than was at first thought and our V-bomber force was greatly prized in the US as the spearhead of Western striking power. The V-force with Blue Steel would serve until 1965, and with Sky Bolt (British-controlled) until 1970. The real question was what should be provided ten years hence, and there was no immediate hurry to decide. It might be that a new, long-endurance carrier for Sky Bolt would be needed, although Polaris was being seriously considered. The RAF must remain flexible and ready to act alone; and it required men with moral and physical courage as well as skill.

Concluding his toast to the squadron, Mr Mure, the Warden of Merton, remarked that there would always be an Oxford University Air Squadron and never a road through Christchurch Meadows.

Reconnaissance Flights

FOLLOWING the U-2 incident, the Air Minister was asked in the House of Commons last week to give instructions to the RAF that no reconnaissance aircraft should fly over Russian territory; and what consultations there had been with the USAF about flights by aircraft based in the UK over Soviet territory "for the purposes of espionage." In his reply, George Ward said it had never been the practice to disclose either the nature or scope of intelligence activities; in his judgement, it would be contrary to the public interest to make an exception to this practice.

Jungle Pioneers

A STANDARD has been presented to No 209 Sqn at Kuala Lumpur, Malaya. The presentation was made by the Commander-in-Chief FEAF, Air Chief Marshal the Earl of Bandon, after the standard had been consecrated by the RAF Chaplain-in-Chief, the Ven F. W. Cocks, who is visiting RAF units in the Far East.

The squadron's associations with that theatre began in 1942 when it was operating over the Indian Ocean from a base in East Africa. It moved to Ceylon in 1945 and has remained in the Far East ever since. Commanded by Sqn Ldr J. Cartwright, No 209 has since 1958 been equipped with Scottish Aviation Pioneers and operates into jungle forts in a mixed transport role. It was originally formed (as No 9 Sqn, RNAS) in 1917 and subsequently flew Nieuport Scouts and Sopwith Triplanes, Pups and Camels on the Western Front. It was disbanded after the First World War and re-formed in 1930 as a flying-boat squadron.

Last Ceremonies

CEREMONIES commemorating two famous RAuxAF squadrons are being held next Sunday and on May 28, when the standards of Nos 607 (County of Durham) and 604 (County of Middlesex) Sqns are laid up, in Durham Cathedral and the RAF Church of St Clement Danes respectively. At the Durham ceremony, which starts on Palace Green at 2.30 on Sunday afternoon, one of No 607's original Hurricanes (P2617) will be on view. The No 604 occasion on May 28 is at 3 p.m in Richmond Terrace, Whitehall. Among those attending will be Gp Capt John Cunningham, who commanded the squadron during the war when controlled night interception techniques were developed.

IN BRIEF

An Army-RAF air transport support demonstration was being held yesterday (May 19) at RAF Abingdon, Berks, and at Arnhem Camp, Watchfield, Wilts.

The RAF mountain rescue team in the Peak District is to move to new headquarters at Stafford following the closure of No 28 MU, at Harpurs Hill near Buxton in Derbyshire, in October this year.

The second annual No 256 Sqn reunion is being held at the RAF Club, 128 Piccadilly, London W1, on Friday, June 10, at 7 p.m. Applications, including a remittance for 12s 6d, should be sent to Flt Lt R. D. Bates, Officers' Mess, RAF Bicester, Oxon.

The last Bristol Beaufighter in the RAF made its final operational sortie on May 12 from Seletar, Singapore, on target-towing duties. Beaufighters went into operational service with Fighter Command in 1940 and more than 5,500 were built.

Pilots of No 1 Sqn who took part in a Hunter fly-past over Chichester recently to mark the city's grant of freedom to RAF Tangmere. From front to rear, they are (left to right): Fg Off F. Marshall, Flt Lt M. Tomkins, Fg Off B. Dimmock; Flt Lt H. Davidson; Fg Off A. Chaplin; Fg Off C. Cameron and Flt Lt A. Neale; and Sqn Ldr J. J. Phipps.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

The SC.1: Congratulations From Bell

THE first successful complete transition of the Short SC.1 on April 6 is an extremely important milestone in the aeronautical world and I should like to use this opportunity publicly to congratulate the engineers at Short Brothers and at Rolls-Royce who have worked very hard to make this accomplishment possible.

We at Bell Aircraft know only too well the trials and tribulations of those who pioneer despite a somewhat slimly funded and supported programme. You may be sure that development of Bell Aircraft's VTO air test vehicle in 1954, and development of the Armstrong Siddeley Viper powered X-14 V/STOL research aircraft (which first made a complete transition on May 24, 1958), as well as development of the X-1, X-2 and X-5 series aircraft, were accompanied by many difficulties, both technical and administrative.

In addition to Bell's success with tilting and deflected jets, and Ryan's success with the tail-sitter, Shorts have now demonstrated the successful use of the "lift engine" concept, including trouble-free air starting of the lift engines. They also have done very useful work on the stability augmentation of VTOL aircraft in hovering and low-speed flight.

Thomas Edison, who once stated that the aeroplane was only half invented as long as it needed to race the length of a runway before it could fly, would no doubt be gratified with the progress that Bell, Ryan and Short Brothers have made in developing the "other half."

Let us hope that those in the British and US Governments who must implement this pioneering work by action to commence the development of operational S/VTOL aircraft systems will not lack the imagination and courage to do their part with alacrity. They now have the ball, and it is an extremely important game for all of us, since high-performance S/VTOL aircraft will offer revolutionary new utility to logistic aircraft systems, and greatly improve flexibility and survivability for aircraft weapon systems. I am convinced that even the most enthusiastic of us cannot imagine the tremendous import of this new capability on the future of the industry.

BELL AIRCRAFT CORPORATION,
George D. Ray, Asst. Dir. of Engineering,
Niagara Frontier Division

Buffalo, NY

Airline Captains' Pay

THREE important events in the aviation world have occurred in the last few weeks. First, the Government has granted certain independents the right to operate scheduled services on certain routes in conjunction with the corporations. Secondly, the independent pilots' application for salary increases has been rejected by the tribunal. Thirdly, the tribunal awarded BEA pilots, already earning more than the independents, a further salary increase.

Thus we are now faced with the situation whereby a service, say to Nairobi, is flown by a Britannia captain in BOAC one day earning £4,000 a year and the next day by the independent captain earning £1,825, although the aircraft are similar.

This may raise several questions. Since the salary bill for the independents is half that of the corporations, are the corporations competing at an unjust disadvantage, and will that be reflected in the comparative profits? Will the independents be able to afford greater passenger luxuries than the corporations? Then there is the moral question of "sweated labour." Passengers must ask themselves if they can fly on airlines that underpay their pilots, especially as flying safety may suffer through money worries.

The whole thing has now become so anomalous and is causing so much unrest among independent pilots that Mr Sandys must step in and exercise Ministerial powers. He has shown great ingenuity in his dealing so far with the corporation cum independent problem and this is no small part of the same problem.

Westcliff-on-Sea, Essex — T. BEVEN

Transport Airships

IN reply to Mr Smith's letter [April 15] perhaps my concern to demonstrate the avoidability of airship accidents in the past led me to neglect the successful ships, of which R.100 was one (as was to be expected from a design presided over by Dr Barnes Wallis and the late Nevil Shute Norway). In fact, I believe R.100 was faster and could carry a bigger payload than the larger and later *Hindenburg*, but, apart from her one Atlantic flight she was never given the chance to prove her worth and she was scrapped after the loss of R.101 as the result of a severe epidemic of cold feet amongst technically ignorant politicians (an apparently incurable, recurrent malaise).

There was talk, at one time, of applying Dr Barnes Wallis' system of goedetic construction, used in the Wellington Bomber, to airship construction and for a fabric covered hull this would have been efficient. My own belief, for what it is worth, is that reliance on fabric to cover such large structures entails too much risk and that the right answer is a hard load-bearing skin of light alloy or, perhaps, plastic, also acting as the gas holder. The use of such a skin, together with the contribution to rigidity derived from the gas pressure, would enable structural scantlings to be reduced. The consequent saving in weight from this and from the ability to dispense with most of the conventional Zeppelin-type internal system of gas cells and wiring should, in a large airship, more than offset the extra weight of the hard skin.

After all, sea-going ships do not have buoyancy systems separate from their hulls; still less can airships, in which considerations of weight are paramount, afford to do so. That the hard-skin principle is sound was demonstrated by the Goodyear Co in the 1920s in a small airship known as ZMC.2.

Southsea, Hants — F. P. U. CROKER

PIA Traffic

THE interesting article by John Stroud on Pakistan International in your issue of April 29 contains a reference to a break-even load-factor of "under 50 per cent" for their leased Boeing 707. This figure appears to be misleading on two counts. In the first case, revenue has apparently been based on a straightforward multiplication of seats by return fares. In practice, of course, the effect of sales commissions, excursion fares, children's and infants' rebates, etc., is to reduce the actual revenue well below Mr Stroud's figure. In the second case, his cost figure appears to be the charter price paid by PIA to PanAm. This presumably excludes such cost items as sales expenditure and general administration.

An outsider cannot adjust the figure to reach the true break-even; but at a rough guess, it would lie between 60 and 70 per cent.

London SW13 — JOHN CORMAC

For the Record

ON page 612 of your issue of April 29 you state that Tangmere had its origin as a military airfield in my forced landing in 1917. Let's get this straight before it's too late. It was 1916. The mistake is due to an inaccurate Air Ministry hand-out when Tangmere ceased to be a fighter station. The actual date was November 19, 1916, and I still have my log-book with "Forced landing near Chichester" in the remarks column.

London W14 — GEOFFREY DORMAN

CORRESPONDENCE IN BRIEF

A group of students at No 2 FTS are compiling a history of that unit and would be grateful for information and photographs. The request comes from A.Plt Off H. Frick, RAF, Syerston, Newark, Notts.

The president of the British Air Mail Society, J. Wotherspoon, of 14 East Main Street, Broxburn, West Lothian, is making research into mail-carrying flights during the 1919 rail strike. He would welcome further information on the flights made by private operators on September 29 and 30 and October 1, and by the RAF from October 1 to 6. The routes flown were London - Manchester - Birmingham - Newcastle - Glasgow, London - Bristol, and London - Sheffield - Barrow.

FORTHCOMING EVENTS

May 20-21. RAeC: Business and Touring Aircraft Competition, Shoreham Airport.
May 21. Association of British Aero Clubs: Summer Convention, RAF Thorney Island.
May 22. Elstree Flying Club: Breakfast Patrol.
May 25. Kronfeld Club: "RAF Wave Expedition in the Lake District," by Gp Capt Kieron.
May 25. Royal Society of Arts: "Problems and Prospects of Air Transport," by Peter G. Masefield.
May 28-29. Skegness Aero Club: International Rally.
May 28. Northern School of Aviation Flying Club: At Home and Flying Meeting, Squires Gate, Blackpool.
May 29. Doubs Aero Club: Touring Aircraft Rally, Besançon.
June 3-4. RAeC: London - Cardiff Air Races, Rhoose Airport.
June 5. Champagne Aero Club: International Rally, Rheims.
June 5-6. Leinster Aero Club Rally.
June 5-6. Fréjus - St Raphael Aero Club: International Provençal Wine Rally.
June 5-6. Vichy Aero Club: International European Aviation Meeting.
June 5-6. Alsace Aero Club: European Light Aircraft Meeting, Strasbourg.
June 6. RAFA Air Display, Hucknall, Nottingham.
June 8. Kronfeld Club: Film on Antarctica Crossing.
June 10. RAeS Rotorcraft Section: "Helicopter Vibration," by Dr J. P. Jones.
June 11-12. Cholet Aero Club: Touring Aircraft Meeting.
June 12. International Landing Contest, Brussels.
June 12. Wolverhampton Aero Club: Competitions Day.
June 17-18. Lozère Aero Club: Rally, Mende-Brenoux.
June 18-19. West Aero Club of France: 14th International Wine Rally, Angers.
June 19. Yorkshire Aeroplane Club At Home, Yeadon.
June 22-28. FAI: Aerial tour of Europe (provisional date).
June 25-27. RAeC: Invitation Air Rally, Escoublac/La Baule.

THE INDUSTRY

Electronic Test-House Approval

MINISTRY OF AVIATION approval as a Part 3 test-house for functional and performance testing of electronic components (including environmental testing) has been granted to Nash and Thompson Ltd, of Hook Rise, Tolworth, Surrey, by the Director-General of Inspection.

This approval—which, states the company, is the first of its kind—means that the standard of work meets official requirements in that all the equipment and reference standards have up-to-date certificates of accuracy, from the NPL or from other approved establishments. The laboratories are also under the supervision of an area inspector.

The Nash & Thompson environmental and electronic testing laboratories have been in existence for more than six years and have long had ARB approval. The company adds that for the past six years it has been the only one under contract to the Ministry's Radio Components Standardization Committee for type-approval testing of electronic components. During this time practically every specification issued by the RCSC has been covered; and, in view of the current changeover from these to the defence specifications, the laboratories have had equipment installed to meet the new requirements.

In addition to the testing of electronic components Nash and Thompson also carry out environmental and functional tests of instruments and small assemblies. Some of the other specifications which have been covered include DTD.1085B, combined temperature, humidity and low air-pressure; MIL-STD-202A, salt spray; DES.1, vibration and acceleration; and G.100, aircraft electrical equipment.

Any firm or organization may submit specimens for testing to a specification, and a certificate is issued stating that the tests have been carried out in accordance with the requirements of the ARB or the Director-General of Inspection.

Environmental work that can be undertaken includes testing at temperatures within the range −100°C to +300°C; low temperature combined with low air-pressure; climatic, tropical-exposure and mould-growth tests; electrical and mechanical life tests; acceleration, vibration and bumping; and testing for air leaks in sealed components over a wide temperature range. The electronic measurements section is equipped to test electrical parameters of components and can undertake d.c. resistance measurements to 1 part in 10,000; capacitance, power factor and inductive measurements over a wide range of frequencies; insulation resistance; voltage breakdown; and voltage and current measurements.

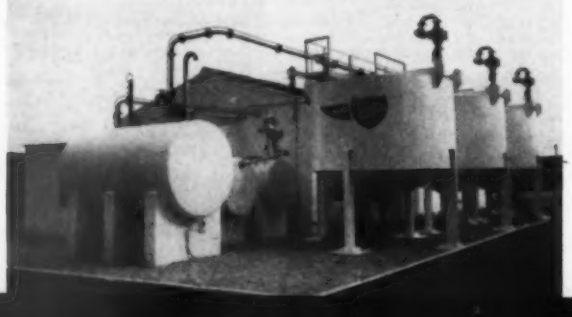
Filtering Fuel

DURING the past decade the importance of removing foreign matter from aviation fuel—always a matter which can mean life or death—has increased enormously. The progressive introduction of turbine-driven aircraft, and particularly those in which anything up to 20,000 gallons must be loaded in the briefest possible time, has placed a heavy burden on filtration plant.

Modern equipment in this field is proven in Air BP's new filtration test unit at Flight Refuelling's airfield at Tarrant Rushton. In the absence of a universally accepted test procedure for such equipment, all Air BP micro-filter and water-separator units are exhaustively evaluated under both laboratory and field conditions before they are placed in use. Full-scale tests at up to 260gal/min were formerly carried out at the BP research centre at Sunbury-on-Thames. The new installation at Tarrant Rushton can pass 500gal/min and is one of the most advanced of its type in the world. As the photograph shows, the complete facility is neat and self-contained. The main test gear is located in one building, surrounded by the fuel and water storage tanks, and its control panel enables one engineer to control the entire operation. In an adjacent building is a laboratory for such tests as the measurement of interfacial tension and the microscopic analysis of slides for particle counting.

Various test sequences can be carried out, including resistance to flow, efficiency of filters and water separation, simulated life tests and backflushing (reverse-flow) investigations. Artificial contaminant and water can be injected into the fuel system at controlled rates and concentrations. Moreover, not only filters but also other items of fuelling equipment can be investigated. At present it is felt that fuelling equipment should be designed to an optimum flow rate of 600gal/min, but investigations are in hand to increase the capacity of the rig from 500 to 700gal/min to meet possible future requirements.

The Air BP filter installation at Tarrant Rushton, described above



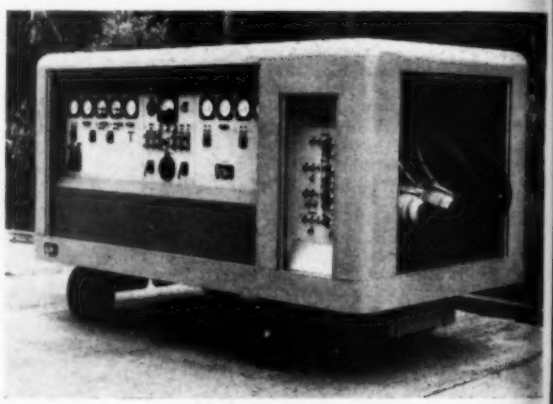
IN BRIEF

M. Holliday has been appointed Rolls-Royce area representative in South Africa in succession to Air Cdre R. J. Legg, who was killed recently in a road accident.

George Kent Ltd announce the appointment of John F. Willsher, general works manager, as a member of the board. He joined the company in 1947 and was instrument division manager from 1955 to 1959.

The Decca Navigator Co has appointed Brig H. G. Willmott, former Air Chief of Staff to the South African Air Force and at one time military adviser to the South African High Commissioner in London, as its representative in Southern Africa.

M. L. Jofeh, OBE, AMIEE, manager of the industrial division, has been elected an additional director of the Sperry Gyroscope Co Ltd. He joined Sperry in 1947 as an equipment engineer and was appointed to his present position in January last year.



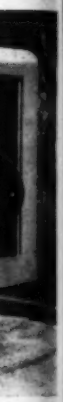
Built for BOAC Boeing 707 electrical testing, the AGE unit dispenses with the need for load-dissipating resistances. A 30 h.p. electric motor drives two aircraft alternators through a dual-output gearbox, and current from the alternator on test passes through the test circuits and is fed to the other, which then runs as a motor and helps to drive the first. A comprehensive interlock system is provided for protection in the event of faults. Aircraft Ground Equipment Ltd, of Blackswarth Road, Bristol 5, are the makers

Two extremely informative brochures have been added to the list of technical publications dealing with I.C.I. titanium; they are *No 2, Physical and Mechanical Properties* and *No 4, Fabrication*. Copies are obtainable from Imperial Chemical Industries Ltd, Millbank, London SW1.

Taylor, Taylor & Hobson are showing an important range of their engineers' measuring instruments in the forthcoming exhibition in Moscow being organized by the Scientific Instrument Manufacturers' Association of Great Britain. The USSR recently placed a considerable contract with the company.

C. W. Lane has been appointed assistant to the general manager (regional sales) of BTR Industries Ltd and is succeeded by Sqn Ldr C. W. Fletcher as sales manager, Palmer Aero Products Ltd, the aero division of BTR. In addition, F. E. Sherras has been made European executive, a newly created post.

Douglas Edwards, formerly Canadian Air Attaché in Bonn, has been appointed technical sales manager, Europe, for A. V. Roe Canada Ltd. He will be representing Avro Aircraft Ltd, Orenda Engines Ltd, Canadian Applied Research Ltd and Canadian Steel Improvements Ltd. Mr Edwards retired from the RCAF on March 31 as a group captain.

The latest *Development News Bulletin* (No 20) issued by Teddington Aircraft Controls Ltd, of Merthyr Tydfil, South Wales, deals with a new type of liquid-oxygen control and metering valve; a multiple-phial type of thermal sensing element; and a stainless-steel valve for aircraft trolley servicing equipment.

D.H. Aircraft (Pty) Ltd, Bankstown, Sydney, have announced two board appointments in addition to those reported in *Flight* on May 6. Rollo Kingsford-Smith, previously commercial manager, has become a director and general manager of the aircraft division; and G. L. A. Spittle, previously manager of the industrial products division of D.H. Engines at Leavesden, has become a director and general manager of the general engineering division.